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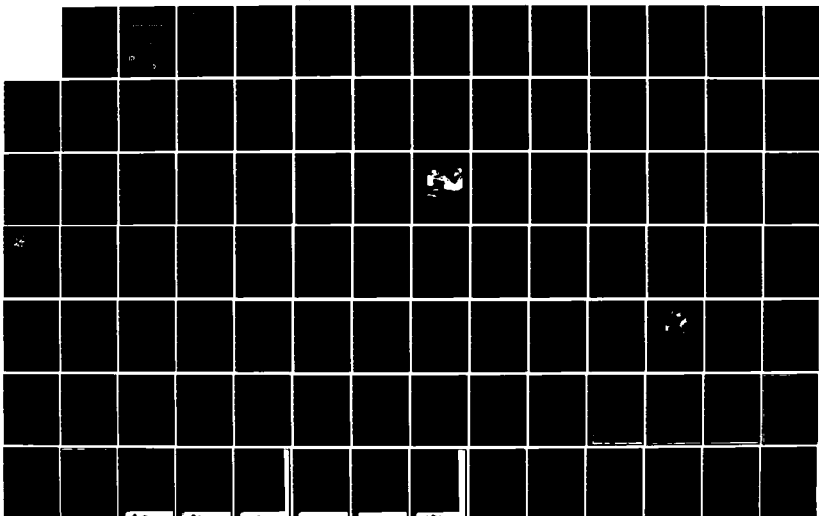
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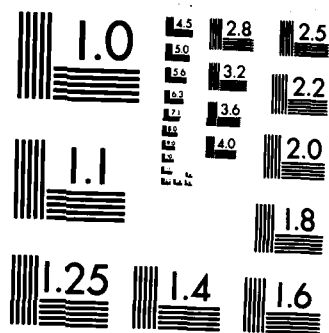
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PASCAGOULA HARBOR, MISSISSIPPI

# FEASIBILITY REPORT

IMPROVEMENT OF THE FEDERAL DEEP-DRAFT  
NAVIGATION CHANNEL

VOLUME I  
MAIN REPORT  
AND

ENVIRONMENTAL IMPACT STATEMENT



US ARMY CORPS  
OF ENGINEERS  
MOBILE DISTRICT

SEPTEMBER 1984

Revised  
March 1985

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Block 20 Continued.

to 42 feet at the present width of 350 feet. The existing Bayou Casotte channel would be deepened to 42 feet and widened to 350 feet and would include a new 1150-foot diameter turning basin just inside the mouth of Bayou Casotte.

Mitigation for the unavoidable loss of 4 acres of emergent wetlands from the construction of the Bayou Casotte turning basin would be provided by restoring 6 acres of disturbed wetland habitat to a natural emergent nature.

Construction is estimated to cost \$57.3 million. Interest and amortization and future maintenance of the channel modifications amount to an annual charge of \$5.4 million. Average annual equivalent benefits amount to \$22.3 million, yielding a benefit-cost ratio of 4.1 to 1.

SADPD-P (14 Sep 84) 1st Ind  
SUBJECT: Pascagoula Harbor, Mississippi, Survey Review Report - 56360

DA, South Atlantic Division, Corps of Engineers, 510 Title Building,  
30 Pryor Street, S. W., Atlanta, Georgia 30335-6801 21 September 1984

TO: Board of Engineers for Rivers and Harbors, Kingman Building,  
Fort Belvoir, Virginia 22060-5576

I concur in the recommendations of the District Engineer.

*Forrest T. Gay, III*  
FORREST T. GAY, III  
Brigadier General, USA  
Commanding

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SAHPD-N

14 September 1989

SUBJECT: Pascagoula Harbor, Mississippi 56360 - Submittal of Final Report

Commander, South Atlantic Division  
ATTN: SAHPD

1. Ten copies of the final Survey Report and Environmental Impact Statement (EIS) for Pascagoula Harbor, Mississippi, are submitted for your review. The final US Fish and Wildlife Coordination Act Report has not been received and will be printed for insertion later. In addition, the EIS is undergoing minor changes as the result of the agency review comments. The EIS will be reprinted upon completion and copies forwarded also.
2. The Mobile District responses to SAD comments on the draft report and EIS are inclosed. Our responses are numerically keyed to those of SAD, however, the page and paragraph references have been correlated with the final report. A copy of the draft Division Engineers Public Notice has been sent to SAD electronically and the original is inclosed. In addition, 20 copies of the mailing list are inclosed.
3. Should you have any questions, please feel free to contact me or the study manager, Mr. Walter W. Burdin at FTS 537-2772.

FOR THE COMMANDER:

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WD

LAWRENCE R. GREEN  
Chief, Planning Division

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## EXECUTIVE SUMMARY

This report presents the findings of a study to determine if widening and/or deepening the existing Federal navigation project at Pascagoula Harbor, Mississippi, would be economically justified and environmentally feasible. The study of deep-draft navigation needs was authorized by a resolution adopted 23 September 1965 by the Committee on Public Works, United States Senate.

The existing Federal deep-draft navigation project for Pascagoula Harbor, Mississippi, was completed in August 1965. The existing project, shown on Plate I, provides for:

An entrance channel 40 feet deep and 350 feet wide from the Gulf of Mexico through Horn Island Pass, including an impoundment area for littoral drift, 40 feet deep, 200 feet wide, and about 1,500 feet long adjacent to the channel at the west end of Petit Bois Island;

A channel 38 feet deep and 350 feet wide through Mississippi Sound and Pascagoula River to a turning basin 38 feet deep, 2,000 feet long, and 950 feet wide (including the channel area) on the west side of the river below the railroad bridge;

A channel 38 feet deep and 225 feet wide from the ship channel in Mississippi Sound to the mouth of Bayou Casotte, and then 38 feet deep and 300 feet wide in Bayou Casotte for about a mile to a turning basin 38 feet deep, 1,000 feet long, and 1,750 feet wide;

Channels in the Pascagoula River and Dog River for smaller craft are also part of the authorized project, but were not considered in the present study since it was primarily oriented towards deep-draft navigation.

The Pascagoula Harbor complex consists of two port areas: one at the mouth of the Pascagoula River and one to the east of Pascagoula on Bayou Casotte. Port and dock facilities on the Pascagoula River consist of two public terminals, warehouses, and a grain elevator. Additionally, Litton Industries' ship-building and repair facilities are located on both banks at the mouth of Pascagoula River. Numerous other industries have private docks.

At Bayou Casotte there are four public terminals and warehouses. In addition, Chevron USA, Corning Glass Works, Chicago Bridge and Iron, Mississippi Chemical Corporation, and First Chemical Corporation have plants and dock facilities on Bayou Casotte. Tennessee Gas Transmission Company has plans to develop dock and terminal facilities there to handle imported liquified natural gas.

The principal difficulties now confronting navigation in Pascagoula Harbor stem from inadequate widths and depths in the existing deep-draft project for the size vessels now calling at the port, inadequate bend widening which presents problems with maneuvering the larger ships at channel bends, and cross-currents in the entrance channel which under certain conditions force

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vessels to progress on a diagonal with the channel. Greater channel dimensions are needed by the tankers transporting crude oil to Bayou Casotte and the petroleum coke carriers loading there and by the bulk carriers exporting grain from the elevator on Pascagoula River. The average sizes in bulk carriers and tankers have been steadily increasing, which compounds the problem. Many of the vessels calling at the port are lightloading to move through the existing channels. The inability of the harbor to accommodate a distribution of vessels that can provide the most economical movement of the principal port commodities is believed to have retarded local industrial development and depressed the general economy of the area.

Inadequate channel and turning basin dimensions in Pascagoula could lead to hazardous situations where the larger vessels are involved. The large volumes of flammable materials moving through the harbor render such a situation hazardous to both life and property. Other difficulties reportedly arise in navigating the entrance channel from the Gulf of Mexico into Mississippi Sound. Local pilots contend that open sea conditions, cross currents, and rapid shoaling of the channel at the west end of Petit Bois Island are such that grounding (i.e., "bumping" or "grazing") is a hazard in navigating that channel.

A number of depths ranging from 40 feet to 55 feet were considered for channel modifications. Economic analyses were performed for all alternative depths and the depth with greatest net benefits is 42 feet. Alternative dredged material disposal concepts considered in the study included upland disposal, enlargement of Singing River Island, extension of Point aux Chenes shoreline, island creation in Mississippi Sound, and disposal in deep water in the Gulf of Mexico.

The recommended plan provides for deepening the existing entrance channel to 44 feet at a width of 550 feet from the gulf to the southern end of Horn Island Pass, then continuing the 44-foot depth through Horn Island Pass at a width of 600 feet. Within Mississippi Sound and into the Pascagoula River, the channel would be deepened to 42 feet at the present width of 350 feet. The existing Bayou Casotte Channel would be deepened to 42 feet and widened to 350 feet and would include a new 1,150-foot diameter turning basin just inside the mouth of Bayou Casotte. Dredged material from Pascagoula River inner harbor, an estimated 623,000 cubic yards, would be deposited in an existing upland disposal site. New work material from the mouth of Pascagoula River to the north end of Horn Island Pass and all of the Bayou Casotte channel material, an estimated total of 11,126,000 cubic yards, would be disposed in deep water of the Gulf of Mexico about 14 miles southwest of Horn Island.

Mitigation for the unavoidable loss of 4 acres of emergent wetlands from the construction of the Bayou Casotte turning basin would be provided by restoring 6 acres of disturbed wetland habitat to a natural emergent nature. New work material to be dredged from the entrance channel (including Horn Island Pass), about 3,348,000 cubic yards, would be disposed in a nearshore area between the 15- and 30-foot depth contours south of Horn Island. Maintenance material from that channel would also be placed in that area. Maintenance material from Pascagoula River would be placed in existing sites at the Double Barrel area and Singing River Island. Maintenance material from Bayou Casotte would be placed in the existing Greenwood Island site. Maintenance material from all channel segments within Mississippi Sound would be placed in the open water sites in the sound presently in use.

Construction of the recommended plan is estimated to cost \$57.3 million. Interest and amortization of the initial investment and future maintenance of the channel modifications amount to an annual charge of \$5.4 million. Average annual equivalent benefits amount to \$22.3 million, yielding a benefit-cost ratio of 4.1 to 1.

PASCAGOULA HARBOR, MISSISSIPPI

FEASIBILITY REPORT

ON

IMPROVEMENT OF THE FEDERAL

DEEP-DRAFT NAVIGATION PROJECT

PASCAGOULA HARBOR, MISSISSIPPI  
Feasibility Report  
on  
Improvement of the Federal  
Deep-Draft Navigation Project

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PASCAGOULA HARBOR, MISSISSIPPI  
Feasibility Report  
on  
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the warmer gulf waters. Heavy rains and high humidity during the summer are probably responsible for occasional low visibility.

A hurricane is a tropical cyclone with wind velocities of 74 mph or greater. Most hurricanes form in zones between 8 and 15 N latitude, where the sea surface temperature is high and the Coriolis force is strong enough to cause the spinning of winds around low-pressure centers. Hurricanes pose a definite threat to the study area from June through October, being most frequent during September. These late summer hurricanes tend to originate in the eastern North Atlantic near the Cape Verde Islands and are often severe. Those hurricanes arising in June and July usually originate in the western Atlantic or Caribbean and tend to be weak (US Army Corps of Engineers, 1981). A total of 57 hurricanes have affected the Gulf of Mexico coastline since 1711, an average of one hurricane every five years. The high winds typically generated by hurricanes are ordinarily not as destructive as the marked rise in water level, referred to as hurricane surge. Hurricane Frederic, the last hurricane to hit the Alabama Coast (12-13 September 1979), had record sustained wind speeds of 145 mph recorded at Dauphin Island. At Mobile, wind speeds were recorded at a record 101 mph. Heavy rains associated with hurricanes lead to increased river discharge and may affect coastal areas for several days. Rainfall associated with Hurricane Frederic amounted to 8.6 inches in Mobile on 12-13 September 1979. The highest recorded total was reported at Merrill, Mississippi, where 9 inches fell in a 24-hour period (US Army Corps of Engineers, 1981). Hurricane Camille, a small but devastating storm, came inland in the St. Louis Bay/Waveland area on 17 August 1969. Winds were estimated near 200 mph at the center of the hurricane with tides rising in excess of 22 feet. The storm almost completely destroyed the entire Mississippi Coast. A tropical storm is a cyclone with maximum sustained surface wind speeds between 39 and 73 mph. In a 178-year period, 17 tropical storms affected the coastal region. The probability of a tropical storm or hurricane affecting the 50-mile area between Biloxi, Mississippi, and Mobile Bay has been calculated as 13% for a tropical storm, 6% for a hurricane, and 1% for a severe hurricane each year (O'Neil and Mettee, 1982).

#### ENVIRONMENTAL CONDITIONS

Biological. Estuarine open water areas dominate the delineated Pascagoula Harbor study area. These areas range in-depth from less than 1-foot MLW to depths greater than 60 feet and contain a variety of resources important to the functioning of the ecosystem. Emergent wetlands, including estuarine and palustrine forms, comprise approximately 16,500 acres of the study area (USACE, 1984). Other important habitats of the study area include seagrasses, forested wetlands, upland forests, and the beach/dune communities of the barrier islands. Numerous wildlife species, migratory waterfowl, and fish and shellfish species utilize these areas throughout their life cycles. In addition, a number of threatened or endangered species may occur within the study area.

the Bayou Casotte channel, data indicates the sides and bottom are covered by a few feet of very soft fine-grained organic silts and clays of medium to high plasticity. It can be inferred that the bottom adjacent to the channel consists of this material, plus very soft clays, in a layer 15 to 20 feet thick. From depths of -40 to -50 the sediments appear to be clayey sands with clean sands and silty sands intermixed.

excavation. No materials have been located which might cause undue difficulty during excavation by hydraulic dredge. Generally, soils above 35 MTL are not suitable for any type of construction. Below that depth the material would be useful for dike construction. Material from Horn Island Pass and the bar channel would be useful for beach nourishment. Side slopes of 1 vertical to 5 horizontal would be in equilibrium.

#### CLIMATE AND WEATHER

The study area has a humid, warm-temperate to sub-tropical climate, although occasional subfreezing temperatures do occur. Air temperatures are influenced by the Gulf of Mexico, with average annual temperatures ranging between 60°F to 70°F. Summer temperatures are influenced by the Bermuda High, a semipermanent high-pressure cell that extends over portions of the Gulf of Mexico near 30°N latitude. During the summer, southerly winds generated by the high-pressure cell have a high moisture content which tends to keep coastal temperatures lower than those of inland areas. Summer temperatures range between 70°F to 90°F. In the winter, winds are northerly and move in cold, continental air masses. Temperatures remain relatively mild, ranging from lows in the 40's to highs in the 60's (°F). The normal annual rainfall within the study area is among the highest in the United States. Rainfall amounts average between 55 to 64 inches. Rainfall is fairly evenly distributed over the year, being greatest during the thunderstorm season in July, averaging 7.6 inches, and least in October and November, averaging 3.5 inches. Thunderstorm frequency is one of the highest in the United States. Relative humidity is fairly constant throughout both the day and the year. Humidity is usually highest between 0400 and 0600 hours (83%) and lowest between 1200 and 2000 hours (62%) [O'Neil and Mettee, 1982].

Although wind direction tends to be variable throughout the year, the overall pattern is for northerly winds from September through February and southerly winds the remainder of the year. Throughout the year, wind speeds average 7-10 knots (Eleuterius, 1978).

Cloudiness tends to be highest in the winter and summer with lower values in the spring and fall. Much of the summer cloudiness consists of convective cumulus or high, thin clouds. Winter cloudiness is generally associated with movement of extra tropical cyclones and their associated frontal systems. Periods of low visibility from November through May correspond with heavy fog periods. Winter fogs are fairly frequent along the Gulf Coast as the larger rivers and tributaries empty cold water into

The Pascagoula River flows directly into Mississippi Sound, draining a 9,400 square mile area. The average discharge of the Pascagoula River is 15,200 cubic feet per second (cfs), which includes the Escatawpa River. Between 1961 and 1981, the annual amount of sediment load entering Mississippi Sound from the Pascagoula and Escatawpa Rivers ranged between 0.35 million tons and 3.9 million tons (Simons, Li and Assoc., 1983).

Otvos (1982) compared navigation charts prepared in 1853 with current navigation charts and concluded that bottom depths within Mississippi Sound have not changed appreciably, with the exception of the disappearance of an "L" shaped shallow area north of the west end of Horn Island and south of Belle Fontaine Point and the existence of dredged material disposal areas. Borings taken within Mississippi Sound along one transect from Bayou Casotte to the west end of Petit Bois Island delineate the depth of Holocene deposits (Otvos, 1976). The recent Holocene deposits are unconsolidated to poorly consolidated sandy/muddy sediment types that have accumulated over the last 10,000 years. Going from north to south, the Holocene deposits outcrop along the north shore and vary in thickness towards the south from 2 to 3 feet near the mainland, thickening to approximately 20 feet in the middle of the Sound and increasing to 40 feet near west Petit Bois Island.

Investigations. Since considerable historical information was available for Mississippi Sound, extensive drilling exploration was not considered necessary for this feasibility study and new drilling was concentrated in the deep water areas of Horn Island Pass and the outer bar channel leg. Fourteen borings were taken along a proposed realignment of the bar channel, beginning off the west end of Petit Bois Island and continuing at about 3,000-foot intervals for 7-1/2 miles into the Gulf of Mexico where water depth exceeded 50 feet. All borings penetrated to an elevation of 65 feet below Mean Tide Level (MTL). To supplement earlier data, two borings were taken in the lower Sound channel approach to Horn Island to a depth of 70 feet below MTL. Appendix A contains a more detailed account of the geotechnical investigations and their results.

Summary of Results. Sediments in the outer bar consist of two types, both containing traces of shell. The coarse grained group includes clean sands, silty sands, and clayey sands in a layer several feet thick covering the fine grained group which consists of lean clays, plastic clay sands, fat clays, and silts. Generally, sediments south of Petit Bois Island into the gulf are of high quality down to a depth of -50 MTL. Data indicates that the bottom of Mississippi Sound along the main channel alignment consists of poor quality very soft, highly organic silts and clays overlying other formations in depths ranging from 2 to 12 feet. The greatest concentration of these sediments is in an area about 4,000 feet either side of the Gulf Intracoastal Waterway. The largest quantity of material is in the next soil group which consists of marginal quality soft fat clays, silty clays, and clayey sands with some shell fragments. This group is underlain by high quality dense coarse-grained silty sands, clayey sands, and clean sands, but unfortunately they lie at depths from -38 to -45 feet MTL. In

docking, loading/unloading vessels. There are other small docks and fish houses located on this channel.

#### BRIDGES AND UTILITY CROSSINGS

Bridges. One railroad bridge and three highway bridges cross the authorized Federal project for Pascagoula. However, all bridges are located north of the upper limit of the deep-draft channel in Pascagoula River and have no effect on the modifications considered in this study.

Cable. A telephone cable belonging to the South Central Bell Telephone Company crosses the project above the mouth of Pascagoula River near the Ingalls shipyards at a depth of 48 feet below mean low water (MLW). Installation was authorized by Department of the Army permit.

Pipelines. Three submarine pipelines cross the project channels in Mississippi. One 20-inch crude oil pipeline owned by the Chevron Pipeline Company (formerly owned by the California-Kentucky Pipeline Company) crosses the Bayou Casotte channel about 1-1/2 miles south of the bayou mouth and crosses the Pascagoula Channel about 3-1/2 miles south of the river mouth. The top-of-line (TOL) elevation at each crossing is 50 feet below MLW. The two remaining pipelines, 12-inch and 16-inch natural gas lines, are owned by the Chandeleur Pipe Line Company. They cross the main channel about 3/4 mile south of the intersection of the other two channels (the "y"). TOL for the 12-inch line is -50 feet MLW and for the 16-inch it is -60 feet MLW. In addition, two "blanks" for future use, a 12-inch and a 20-inch have been installed at the same location. Both "blanks" have a TOL elevation of -60 feet MLW. All pipeline crossings were authorized by Department of the Army permits.

#### GEOTECHNICAL CONDITIONS

Geology. Physiographically, the coastal zone within the study area is designated coastal lowlands, ranging from sea level to about 30 feet in elevation. These essentially flat to gently undulating, locally swampy lowlands are underlain by alluvial, deltaic, estuarine, and coastal deposits which merge with the fluvial-deltaic plains of the streams in the area. Many tidally influenced creeks, rivers, and estuaries indent the lowlands. The Pascagoula River occupied about the same position in the past as it does today; however, the Escatawpa River followed a different course. A complex system of meanders near Orange Grove and Pecan and south of these locations indicate that the Escatawpa River flowed due south/southeast and emptied into Grand Bay. Bayous Cumbest and Heron are remnants of the main Escatawpa River channels which built a sizeable delta into Grand Bay and Portersville Bay (Eleuterius, 1978).

operated as a one-way traffic channel controlled by the Jackson County Port Authority and the Pascagoula Bar Pilots' Association with guidance from the U.S. Coast Guard. Vessels usually maintain a speed of 10 to 12 knots in the main channel, utilizing it on a first-in-first-out basis as much as possible. When two vessels traveling in opposite directions need to use the channel concurrently, an economic comparison is used to determine priority. The ship with the more expensive operating cost would sail first. Following in the same direction is allowed at a distance of one mile or more.

The introduction of Liquid Natural Gas (LNG) tankers to Pascagoula Harbor would alter current operating procedures. Because of the hazards associated with the tankers, LNG vessels will only be permitted to sail and dock in the harbor during daylight hours. The LNG tankers are expected to travel at a speed of 3 knots with Bayou Casotte at the present width and of 6 knots if that portion is widened. The Chevron tanker Frankfurt is routinely scheduled for daylight travel also because of the present 250-foot width of Bayou Casotte. She would sail on a 24-hour basis with a sufficient width improvement.

#### EXISTING PORT FACILITIES

The Pascagoula Harbor complex has two port areas. One is on both sides of the Pascagoula River beginning at the mouth and extending upstream about 1-1/2 miles and the other is the industrial complex located on the Bayou Casotte Channel to the east of Pascagoula. Public port and dock facilities located on the Pascagoula River consist of two terminals and warehouses owned and operated by Jackson County Port Authority (JCPA). These facilities are designated as terminals "A" & "B." Litton Industries operates a large ship construction facility on the west bank of the Pascagoula River and Ingalls Shipbuilding, a division of Litton Industries, operates a large ship/submarine repair yard located on the east bank of the Pascagoula River. Louis Dreyfus Grain Corporation operates a grain elevator and dock facilities on the west bank just north of Ingalls. This is a privately operated public facility open to all shippers on equal terms. Services and charges are set by the JCPA. Private docks, terminals, repair yards, and fish houses/docks, are owned and/or operated by Quaker Oats, F. B Walker Shipyard, Hudship, Halter Marine, Mississippi Menhaden, Fish Meal Company, Standard Fish Meal Company, International Paper Company, and numerous other fishing and small boat repair facilities.

On the Bayou Casotte Channel, the JCPA owns and operates terminals "E", "F", "G", and "H". Chevron, U.S.A. operates a large petroleum and chemical refinery and ship/barge docking facilities. Corning Glass Works, Chicago Bridge and Iron, and Mississippi Chemical Companies have plants and dock facilities on the Bayou Casotte Channel. First Chemical Corporation has a plant adjacent to the turning basin, but uses JCPA terminal "F" for

Bay, Alabama, and about 100 miles east of New Orleans, Louisiana. This study included the metropolitan area of Pascagoula, pertinent portions of Jackson County, and that portion of Mississippi Sound in the vicinity of the Federally-authorized deep-draft navigation channel. That area considered tributary for economic studies encompassed a major portion of the midwestern United States. For environmental studies, the area of concern encompassed the region bounded by the Pascagoula River on the west, the Point aux Chenes marshes on the east, Interstate Highway 10 on the north, and the Gulf of Mexico on the south. For reference purposes, the navigation complex was divided into six segments: the Entrance Channel (which included Horn Island Pass and the outer bar), the Lower Pascagoula Channel (or Lower Sound Channel), Upper Pascagoula Channel (sometimes called the Pascagoula River Channel), and Bayou Casotte Channel, Pascagoula Inner Harbor, and Bayou Casotte Inner Harbor. These channel segments are shown on Plate IV. The Gulf Intracoastal Waterway passes through Mississippi Sound, crossing the Lower Pascagoula Channel, but was not a part of this study.

#### EXISTING PROJECT DESCRIPTION

The existing Federal deep-draft navigation project for Pascagoula Harbor, Mississippi, was completed in August 1965. The existing project, shown on Plate I, provides for:

An entrance channel 40 feet deep and 350 feet wide from the Gulf of Mexico through Horn Island Pass, including an impoundment area for littoral drift, 40 feet deep, 200 feet wide, and about 1,500 feet long adjacent to the channel at the west end of Petit Bois Island;

A channel 38 feet deep and 350 feet wide through Mississippi Sound and Pascagoula River to a turning basin 38 feet deep, 2,000 feet long, and 950 feet wide (including the channel area) on the west side of the river below the railroad bridge;

A channel 38 feet deep and 225 feet wide from the ship channel in Mississippi Sound to the mouth of Bayou Casotte, and then 38 feet deep and 300 feet wide in Bayou Casotte for about a mile to a turning basin 38 feet deep, 1,000 feet long, and 1,700 feet wide;

Channels in the Pascagoula River and Dog River for smaller craft are also part of the authorized project, but were not considered in the present study since it was primarily oriented towards deep-draft navigation.

#### EXISTING CHANNEL OPERATIONS

Pascagoula Harbor has a "Y" configuration deep-draft channel which is approximately 12 nautical miles long from the docking facilities on Pascagoula River or Bayou Casotte to the farewell buoy. The harbor is



## PROBLEM IDENTIFICATION

### OVERALL OBJECTIVES

Planning objectives are the National, State, and local water and related land resource management needs specific to the study area that can plausibly be addressed by this study that would enhance national economic development with protection of the environment. The following planning objectives were derived from a large range of public and professional concerns and from the existing problems and needs of the area:

- a. Improve the economic efficiency of moving commodities in and out of Pascagoula Harbor.
- b. Increase navigational safety in Pascagoula Harbor and reduce hazards to life and property.
- c. Provide an adequate and acceptable dredged material disposal plan for project modifications and continued maintenance.
- d. Enhance the quality aspects of water, land, and air.
- e. Reduce adverse impacts of current periodic dredging activities.
- f. Reduce or prevent additional saltwater intrusion into the fresh groundwater aquifers.
- g. Provide additional water-based recreation opportunities in the study area.
- h. Protect, enhance, or create areas of natural beauty and human enjoyment on Petit Bois Island and Horn Island.
- i. Avoid or minimize irreversible commitments of resources to future uses.
- j. Manage, protect, preserve, or enhance valuable resources such as:
  - (1) oyster reefs
  - (2) productive marsh and wetlands
  - (3) sport fish habitat
  - (4) shrimp nursery grounds and migratory routes

### EXISTING CONDITIONS

#### STUDY AREA

Pascagoula Harbor is located at the mouth of the Pascagoula River, in Jackson County, Mississippi, about 32 miles west of the entrance to Mobile

The 1960 River and Harbor Act also authorized and directed an immediate study of the project authorized by the River and Harbor Act of 1954 (Public Law 790, Eighty-third Congress), House Document Numbered 98, Eighty-sixth Congress, to determine if further modification was warranted, and also authorized further modifications as determined to be justified by the Secretary of the Army with the approval of the President, unless within the first period of 60 calendar days of continuous session of the Congress after the date on which the report is submitted to it, such report be disapproved by Congress. The report, published in House Document 65, 87th Congress, 1st Session, was transmitted to Congress on 13 January 1961 and recommended modifications to provide for deepening the Horn Island Pass channel to 38 feet; deepening the main ship channel in Mississippi Sound, the Pascagoula River channel to the railroad bridge, and the turning basin to 33 feet. Construction of the improvements recommended was completed 13 June 1962.

The report published in House Document 560, 87th Congress, 2d Session, recommended modifications of the existing project to provide for an entrance channel, from deep water in the Gulf of Mexico through Horn Island Pass, 40 feet deep and 350 feet wide, including an impounding area for littoral drift 40 feet deep, 200 feet wide, and about 1,500 feet long adjacent to the channel at the west end of Petit Bois Island; a channel 38 feet deep and 350 feet wide in Mississippi Sound and the Pascagoula River to the railroad bridge at Pascagoula, including a turning basin approximately 2,000 feet long and 950 feet wide (including the channel area) on the west side of the river below the railroad bridge; and a channel 38 feet deep and 225 feet wide from the ship channel in Mississippi Sound to the mouth of Bayou Casotte, thence 38 feet deep and 300 feet wide for about one mile to a turning basin 38 feet deep, 1,000 feet wide, and 1,750 feet long. The improvement was authorized by the 1962 River and Harbor Act and the work was completed in August 1965. The existing project is shown on Plate I.

#### STUDY MANAGEMENT

The Corps of Engineers was responsible for the conduct and coordination of this study, the formulation of plans, and the preparation of this feasibility report. The study was conducted by a multidisciplinary study team. The study was coordinated with appropriate Federal, State, and local agencies including the U. S. Fish and Wildlife Service, Environmental Protection Agency, National Marine Fisheries Service, National Park Service, Mississippi Department of Wildlife Conservation, Bureau of Marine Resources, Mississippi Bureau of Pollution Control, Gulf Coast Research Laboratory, Jackson County Port Authority, and Jackson County Board of Supervisors.



This report is a complete response to the resolution quoted in a above. Study of the shallow-draft channels, as requested by the resolutions in b. and c., was deferred at the request of the sponsor and will be addressed in a later report.

#### SCOPE

This study considered the need for modification of the existing Federal project at Pascagoula Harbor in Jackson County, Mississippi, to accommodate present and prospective commerce. The primary study area included the Federal project and all lands and waters directly impacted by the project. The secondary study area included the inland states serviced by the harbor or using commodities shipped through the harbor. That area is shown in Figure 1.

Plans were formulated to meet the identified needs, where feasible, and associated costs and benefits were estimated. The economic, environmental, and social impacts of the proposed improvements were assessed. The study was performed in sufficient detail to determine what resource management measures or systems would be in the overall public interest at Pascagoula Harbor and should be recommended for Congressional authorization.

#### PUBLIC INVOLVEMENT

Input from the public has been sought at various stages of the study. This report and Environmental Impact Statement will be made available to known interested parties.

#### PRIOR STUDIES AND REPORTS

Twenty reports have been prepared concerning navigation improvements in the Pascagoula Harbor area. The first report on the harbor system was submitted in 1828 and was not published. The most recent reports of interest in connection with the current investigation are described briefly in the following paragraphs.

A report published in House Document Number 98, 86th Congress, 1st Session, recommended project modifications to provide a channel with minimum dimensions of 35 by 325 feet through Horn Island Pass, and 30 by 275 feet through Mississippi Sound and up Pascagoula River to the railroad bridge, and a turning basin 30 feet deep on the west side of the channel below the railroad bridge; maintenance of the channel in Dog River, from the upper limits of the existing project at mile 4 to the vicinity of mile 6, to minimum dimensions of 12 by 125 feet; and for maintenance of the 30- by 225-foot channel from Mississippi Sound to Bayou Casotte, thence 30 by 300 feet in Bayou Casotte to a turning basin of the same depth. The improvement was authorized by the River and Harbor Act approved 14 July 1960.

PASCAGOULA HARBOR, MISSISSIPPI  
NAVIGATION IMPROVEMENT

INTRODUCTION

This report presents the final results of a study to determine if widening and/or deepening the existing Federal navigation project at Pascagoula Harbor, Mississippi, would be economically justified and environmentally feasible. The report recommends that the channel be deepened to an authorized depth of 42 feet throughout, that the Bayou Casotte leg be widened to 350 feet, and that several other minor modifications be made to facilitate navigation and ease maintenance operations. The study process to arrive at that recommendation is discussed in subsequent sections.

AUTHORITY

This study was authorized by several resolutions adopted by the Senate and House Public Works Committees. Those resolutions requested studies to determine if modifications to the existing navigation project for Pascagoula Harbor are warranted.

a. The resolution adopted 23 September 1965 by the Committee on Public Works of the United States Senate reads, in pertinent part,

"That the Board of Engineers for Rivers and Harbors . . . is hereby requested to review the report of the Chief of Engineers on Pascagoula Harbor, Mississippi, . . . with a view to determining the advisability of modifying the project at this time."

b. The resolution adopted 10 February 1971 by the Senate Committee reads, in pertinent part,

"That the Board of Engineers for Rivers and Harbors . . . is hereby requested to review the report of the Chief of Engineers on the Intracoastal Waterway from Mobile, Alabama, to New Orleans, Louisiana, . . . with a view to determining whether any modifications of the recommendations contained therein are advisable at this time, with particular reference to providing a channel 12 feet deep and 150 feet wide from approximately mile 93 on the Gulf Intracoastal Waterway to the Pascagoula River Channel in the vicinity of the proposed barge fleeting area south of Ingalls West Bank Facility."

c. The resolution adopted on 23 June 1971 by the Committee on Public Works of the United States House of Representatives has the same wording as the Senate Resolution in b above.

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Freshwater marshes containing reed (Phragmites australis), switch grass (Panicum virgatum), wild rice (Zizania aquatica), sawgrass (Cladium jamaicense), alligator weed (Alternanthera philoxeroides), arrowhead (Sagittaria spp.), and cattails (Typha spp.) are present north of the Interstate Highway 10. These freshwater marshes intergrade with the extensive brackish marsh community of the Pascagoula River delta. The black needlerush (Juncus roemerianus) is the dominant form in these marshes; other species include saltmeadow cordgrass (Spartina patens), cattails, spike rush (Eleocharis spp.), reeds, bulrushes (Scirpus spp.), marsh mallow (Hibiscus moscheutos), and sawgrass. These brackish marshes intergrade with the saline marshes dominated by black needlerush. Smooth cordgrass (Spartina alterniflora) is locally abundant in the intertidal zone of the saline marsh. Other common species include saltgrass (Distichlis spicata), saltmeadow cordgrass, salt marsh aster (Aster tenuifolius), marsh gerardia (Agalinis maritima), and sea lavender (Limonium nashii).

Saline and brackish marshes comprise a significant portion of the coastal area of mainland Jackson County. Within the study area an extensive saline marsh extends westward from the Alabama/Mississippi state line around Point aux Chenes Bay to just west of Point aux Chenes where the development of the Bayou Casotte and Pascagoula Industrial areas precludes marsh development. The Pascagoula River delta area also supports diverse saline and brackish marshes. Saline marshes are present south of Highway 90 between the east and west mouths of the river. In the area north of Highway 90, brackish marshes are dominant and intergrade into freshwater marshes north of Interstate 10. Petit Bois and Horn Islands support saline marshes, along their protected shores, which appear to be zoned according to period of inundation. Smooth cordgrass exists in the shallow subtidal/intertidal areas; black needlerush and spike rush occur in an intermediate zone with saltmarsh fimbriatylis (Fimbristylis castanea) and saltmeadow cordgrass present at higher elevations. Singing River Island, which has evolved as a result of dredged material disposal practices, is encircled by saline wetlands.

Due to the high turbidity conditions within this area, submersed grassbeds have limited distribution within the study area. Approximately 700 acres of submersed grassbeds were identified within the study area in 1979 (USACE, 1984). These beds are restricted to shallow areas of less than 6 feet in depth, primarily along the northern shores of Horn and Petit Bois Islands. The Horn Island grassbeds are relatively diverse with mixtures of manatee grass (Cymodocea manatorum), turtle grass (Thalassia testudinum), and shoal grass (Halodule wrightii). Petit Bois Island has large expanses of diverse grassbeds predominately of shoal grass. Manatee and turtle grass and Halophila engelmanni (no common name) are found intermixed with the shoal grass (US Department of Interior, 1978). In the grassbeds, significant quantities of benthic and epibenthic macroalgae, including red, green, and brown species, are present (Humm and Caylor, 1957).

Forested wetlands occur on the flood plain of the Pascagoula and Escatawpa Rivers and their tributaries. Dominant vegetation in these areas varies, depending on the amount and duration of flooding. Within the study area, evergreen needle-leaved forests predominate and are characterized by white cedar (Chamaecyparis thyoides), pond pine (Pinus serotina), sparkleberry (Vaccinium arboreum), yaupon (Ilex vomitoria), and red maple (Acer rubrum). Eleuterius and Jones, 1972, indicated that the western terminus of white cedar distribution is the Pascagoula River Basin. A large stand of white cedar is located just north of the study area at Van Cleve, Mississippi. Broadleaf evergreen and deciduous forests make up the remainder of the forested wetlands in the study area. These areas are characterized by such species as swamp bay (Persea palustris), sweet bay (Magnolia virginiana), swamp tupelo (Nyssa sylvatica), water oak (Quercus nigra), laurel oak (Q. laurifolia), sweet gum (Liquidambar styraciflua), southern magnolia (Magnolia grandiflora), and tulip tree (Liriodendron tulipifera). Pond cypress (Taxodium distichum) also occurs in the more flooded areas. Understory plants occurring in the forested wetlands include Virginia willow (Itea virginica), swamp cyrilla (Cyrilla racemiflora), black titi (Cliftonia monophylla), and wax myrtle (Myrica cerifera).

Upland forested areas are characterized by species of the longleaf pine-oaks association and are usually xeric sandy sites above the 10-foot contour. Species in these areas include longleaf pine (Pinus palustris), southern red oak (Q. falcata), laurel oak, flowering dogwood (Cornus florida), and persimmon (Diospyros virginiana). Other upland forested areas include species of the moist pineland association and may form a strip between the forested wetlands and the more upland long-leaf pine-oaks forest. Common species of the moist pinelands are slash pine (P. elliotti), saw palmetto (Serenoa repens), and wax myrtle.

The barrier islands support two unique habitats; the maritime strand forest and the beach/dune associations. The land-water interfaced along Horn and Petit Bois Islands is characterized by beach conditions which support sea oats (Uniola paniculata), morning glory (Ipomoea spp.), and pennywort (Hydrocotyle bonariensis). The beaches intergrade into extensive dune conditions vegetated by saw palmetto, seaside rosemary (Ceratiola ericoides), sea oats, morning glory, and pennywort. Landward of the dune system, the longleaf pine-oaks association is modified, consisting of fewer plants adapted to more rigorous growing conditions, such as coarse white sand and salt spray. This maritime strand forest is characterized by scrubby live oak (Quercus virginiana var. geminata), seaside rosemary, seaside balm (Conradina canescens), slash pine, and saw palmetto.

A large portion of the study area is urban or industrial in nature. The cities of Pascagoula, Moss Point, and Gautier are located in the center, northeast, and western portions of the study area. Mainland areas that have been used for disposal of dredged materials include Greenwood Island, Singing River Island, Point Toussant, and areas along the upper East Pascagoula River and lower West Pascagoula River.

A large number of organisms, including both terrestrial and aquatic forms, utilize the diverse habitats of the study area. Zooplankton, although extremely important to the functioning of the estuarine and coastal systems, are not well known in the study area. Copepods and ctenophores are the dominant forms with Acartia tonsa being the most numerous of the copepods. Fish larvae and eggs are also dominant items of the zooplankton during certain times of the year.

Benthic macroinfauna can best be described in terms of communities which are defined by a combination of physical/biological characteristics, i.e., sediment texture, organic content, and species distribution and abundance. Table 1 indicates the relative abundance of the benthic communities described for the study area.

TABLE 1

Selected Benthic Community Distribution Within the Pascagoula Harbor Study Area <sup>2/</sup>	
<u>Community Type</u>	<u>Area (Acres)</u>
Oyster Reefs	570
Coastal Margin Mud	6,429
Open Sound Muddy Sand	50,654
Shallow Sound Clean Sand	756
Tidal Pass Clean Sand	2,229
Offshore Clean Sand	6,070
Offshore Mud	5,688
Offshore Muddy Sand	2,048

<sup>2/</sup> Calculated from US Army Corps of Engineers, 1982

The coastal margin community occupies the bottoms adjacent to the mainland shore. Species of this community are characteristic of shallow, muddy, hydrographically variable environments. The open sound muddy sand community occupies most of the Mississippi Sound portion of the study area and occurs in bottoms 6.8 to 18.4 feet deep containing poorly-sorted, medium silt to very fine sand which are relatively hydrographically stable. The offshore mud community is located nearshore to the barrier islands and is characterized by shallow, muddy, and hydrographically variable conditions. The offshore muddy-sand community is located in deeper waters, seaward of the mud communities, with very fine sand sediments and hydrographically stable conditions. Sandy habitat of the study area contains an assemblage of ubiquitous taxa. A small assemblage of predominately opportunistic species is restricted to the shallow sand areas and another assemblage of opportunistic species is restricted to tidal pass areas. A group of stenohalin organisms is restricted to and characteristic of the offshore clean sand.

Comparing the communities, the open sound muddy sand communities contain approximately four times the number of organisms of the coastal margin communities and two times the density of the clean sands. Offshore mud and muddy sand communities had generally moderate densities and low biomass. In general, mud communities contained more annelids and the greatest proportion of the community is located at depths greater than 5 cm. The muddy sand communities contained a greater proportion of individuals at depths less than 5 cm. Approximately 90% of the individuals in the sand communities occupy the upper 10 cm of sediment and this community contains more crustaceans than other communities (USACE, 1982).

The major fisheries landed along the Mississippi Gulf Coast are the anchovies (Anchoa mitchilli and A. hepsetus), menhaden (Brevoortia patronus), mullet (Mugil cephalus), croakers (Micropogonias undulatus and Leiostomus xanthurus), the shrimp (Penaeus aztecus and P. setiferus), blue crab (Callinectes sapidus), and the oyster (Crassostrea virginica). Jackson County, primarily the ports of Pascagoula and Moss Point, receives greater than 85% of all Mississippi landings, including all industrial fish (menhaden), 95% of the mullet, trout, and red snapper, and 74% of the croakers landed. In 1983, the landings through the ports of Pascagoula and Moss Point had a value of \$23.2 million and consisted of 68% menhaden, 29% croaker, 1% red snapper, and 1% shrimp.

These species are estuarine dependent, i.e., they spend part or all of their lives in estuaries. A typical estuarine-dependent species spawns in the Gulf of Mexico, and the larvae are then carried towards shore by currents. By the time the young are big enough to swim, they are near the mouths of estuaries, which they then enter. The young remain in the estuaries for about one year, taking advantage of the greater availability of food and protection which estuarine habitats afford. Most estuarine-dependent species grow rapidly and reach maturity at one year of age. They may then remain in the estuary, migrate to sea to spawn (returning to the estuary between spawnings), or migrate from the shallow estuaries to spend the rest of their lives in the deeper Gulf of Mexico. Of course, other species may spend their entire life cycles within the estuary, while others that typically occur farther offshore may never be found in the bays (Hoese and Moore, 1977).

The stages from the egg to juvenile, during which transport from offshore waters to low salinity areas is accomplished, is probably the most critical of all in the life histories of the important fishery organisms of the Mississippi Gulf Coast. The threat to individuals during this time may be broken down into three distinct phases: (1) transport from the offshore waters to the vicinity of the tidal passes or bay mouths; (2) transport through the passes into the bays; and (3) distribution within the bays after entrance has been obtained (Gunter, 1967). Since these forms are typically incapable of sustained locomotion, any change in normal current speed or direction would severely impact the growth of the species.

The majority of the fish of the study area spawn in the Gulf of Mexico from the nearshore waters of the barrier islands and tidal passes to depths in excess of 4,500 feet near the edge of the outer Continental Shelf. Spawning activities are more concentrated in depths less than 100 feet and particularly in the nearshore areas on the Gulf side of the barrier islands and in the deeper waters of the tidal passes. In deeper water (over 100 feet) spawning occurs in all months, probably due to the more stable temperature regime of these waters. In shallower waters, spawning activities are more concentrated in spring through summer months in response to warmer temperatures and variable salinity conditions. Larval migration into the estuaries is effected through the tidal passes, both in surface and bottom waters. Some species passively migrate utilizing flood tide currents, while others are able to migrate against ebbing currents. Migration typically begins in the early spring with larval and post larval stages moving through the tidal passes and into shallow areas of the estuary.

Spawning activities are more concentrated in depths less than 100 feet and particularly in the nearshore areas on the Gulf side of the barrier islands and in the deeper waters of the tidal passes. In deeper water (over 100 feet) spawning occurs in all months, probably due to the more stable temperature regime of these waters. In shallower waters, spawning activities are more concentrated in spring through summer months in response to warmer temperatures and variable salinity conditions.

Migration typically begins in the early spring with larval and post larval stages moving through the tidal passes and into shallow areas of the estuary. In summer, many larvae and juveniles tend to move to somewhat deeper water and very heavy usage is seen in areas with submerged vegetation. The autumn migration of late juveniles is towards deeper waters within the Sound, into the tidal passes and into shallow offshore Gulf of Mexico.

The mainland margins of the Sound, the margins of Horn and Petit Bois Islands, and the grassbeds of these barrier islands serve as the dominant nursery grounds during spring and summer. In autumn, these areas are still important but usage is not as heavy due to the seaward migration of many late juveniles (Benson, 1982 and US Army COE, 1984).

Oyster resources within the study area are restricted to Point aux Chenes Bay, Bangs Lake, and an area near the mouth of the West Pascagoula River. The West Pascagoula reef, which represents over 95% of the oyster resources of the study area, has been permanently closed to oyster harvest since the early 1960's due to poor water quality conditions; however, this reef serves as spat source for other reefs in the area.

Brown and white shrimp and blue crab are commercially important estuarine dependent species which utilize the study area. In the estuaries post-larval and juvenile shrimp prefer soft bottom, shallow areas near marshes; adults prefer deeper areas with both mud and sandy bottoms. In the

offshore area, brown shrimp are found on mud and sandy bottoms (Van Lopik et al., 1979). Juvenile blue crabs live in the estuarine nursery grounds throughout the year, congregating in channels with soft mud sediments and in the saline and brackish marshes that fringe the bays and coastline. Juvenile crabs prefer lower salinities (5 to 15 ppt) and mud bottoms (Benson, 1982). Adult crabs exhibit a differential distribution by sex with males tending to remain in low salinity areas and females in waters with salinities above 20 ppt. The adults tend to migrate into deeper waters with decreasing water temperatures in the late summer and fall.

A number of amphibians and reptiles occur in the diverse habitats of the study area, including salamanders, frogs, toads, snakes, and turtles. One species of note within the study area is the yellow-blotched sawback turtle (Graptemys flavimaculata) which is restricted to the Pascagoula River drainage system. Five species of sea turtles are found in nearshore Gulf waters and two of these, the green sea turtle (Chelonia mydas) and the Atlantic ridley (Lepidochelys kempi), may enter Mississippi Sound. The loggerhead turtle (Caretta caretta caretta) at one time nested on the barrier islands. It is possible that this species still utilizes Petit Bois and Horn Islands for nesting (US Army COE, 1984); however, the last reported nesting attempt was in the mid-1960's (Jackson, 1983).

The coastal marshes, swamps, islands, and beaches of the study area support large populations of passerine birds, waterfowl, wading birds, and shore birds. Active nesting sites located within the study area include: a black skimmer (Rynchops nigra) colony north of Ingall's near the East Pascagoula River; least tern (Sterna albifrons) colonies on Horn Island and Petit Bois Island; a black skimmer, Caspian tern (Hydroprogne caspia), gull-billed tern (Gelochelidon nilotica), least tern, royal tern (Thalasseus maximus), and sandwich tern (T. sandvicensis) colony on Petit Bois; and a cattle egret (Bubulcus ibis), great egret (Casmerodius albus), and Louisiana heron (Hydranassa tricolor) heronry on Petit Bois Island. Shorebird nesting has also been noted on the disposal island (Sand Island) adjacent to the entrance channel.

A number of coastal mammals may be found in the project area, including gray squirrel (Sciurus carolinensis), nutria (Myocastor coypus bonariensis), muskrat (Ondatra zibethicus rivalicus), and numerous other rodents. Marine mammals which utilize the sound and offshore area include dolphins (Tursiops truncatus and Stenella plagiodon), an occasional manatee (Trichechus manatus latirostris), and several species of whales.

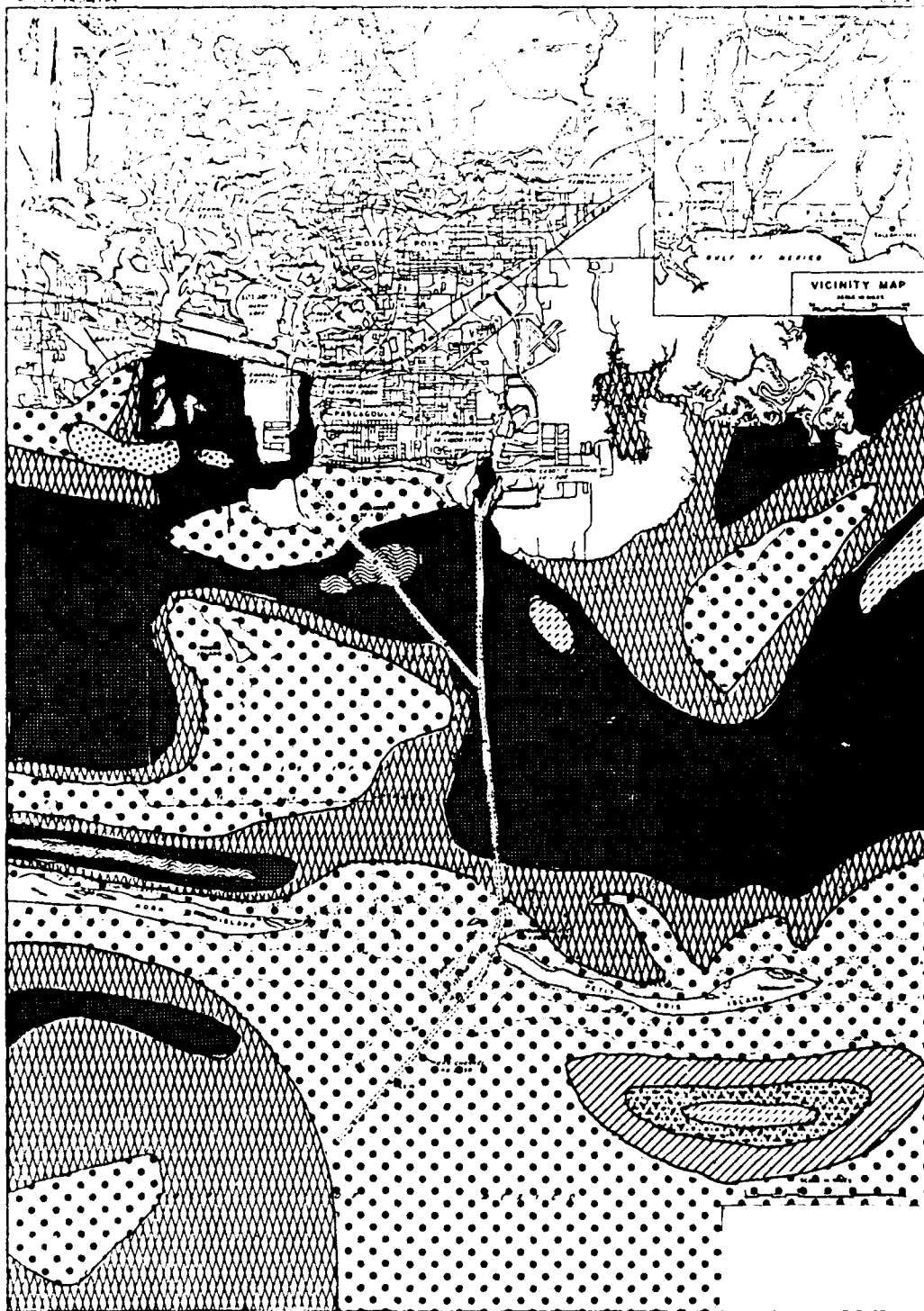
Endangered and Threatened Species. The study area is within the reported range of a number of Department of Interior and State of Mississippi designated endangered and threatened species. Species on both the State and Federal lists include the American alligator (Alligator mississippiensis), Atlantic loggerhead turtle (Caretta caretta caretta), green sea turtle (Chelonia mydas), eastern indigo snake (Drymarchon corais couperi), peregrine falcon (Falco peregrinus), bald eagle (Haliaeetus leucocephalus), brown pelican (Pelecanus occidentalis), Bachman's warbler

(Vermivora bachmani), and Florida panther (Felis concolor coryi). Species listed on the State of Mississippi endangered and threatened species list include the Atlantic sturgeon (Acipenser oxyrinchus), the southern coal sking (Eumeces anthracinus pluvialis), rainbow snake (Farancia erythrogramma), yellow-blotched sawback turtle (Graptemys flavimaculata), black pine snake (Pitophis meloleucus lodingi), and Florida black bear (Ursus americanus floridanus). The critical habitat of the Mississippi Sandhill Crane (Grus canadensis mississippiensis) is within Jackson County.

**Sediments.** Several factors contribute to the sediment distribution within the Mississippi Sound portion of the study area. These factors include freshwater inflow from the Pascagoula River system, overall water circulation (wave, wind, tidal), reworking of eroded sediments, storm events, and the flocculation of sediments. The silty sand/sandy silt association near the Grand Batture Islands reflect erosion of the relic Pleistocene from the old Escatawpa River delta. The sand/clay/silt mixture reflect the variability of circulation patterns within this area and the flocculation/settling process of suspended sediments within the water column. The silty clay/clayey silt zone, south of Belle Fontaine Point, probably is due to the flocculation and settling of sediments carried by the West Pascagoula River. Horn Island to the south shelters this area from the waves, winds, tides, and storms originating in the Gulf of Mexico causing water velocities to decrease.

Bottom sediments along the navigation channel range from silt and clay/muds (less than 62 microns) to fine to medium sands (Figure 2). The harbor facilities are within a silt and clay/mud region. The Bayou Casotte Channel is primarily in a silt and clay/mud region, while the Pascagoula Channel immediately south of the harbor, transitions to fine and very fine sands (62 to 250 microns). Approximately two miles south of the harbor mouth, the channel transitions back to silt and clay/mud and then near the confluence with the Bayou Casotte Channel returns to sandy material. The upper half of the Mississippi Sound Channel (south of the intersection of Pascagoula and Bayou Casotte Channels) is silt and clay/mud and the lower half is sandy material. Medium and coarse sands lie along the mainland beaches west of the Pascagoula River as well as along the barrier islands. East of the Pascagoula River to Mobile Bay, fine sands, silts, and clays dominate the mainland border.

Petit Bois and Horn Islands consist of a broad, well-developed beach backed by dunes on the gulf side. Beach and intermittent marsh, backed by dunes occur on the north shore of the islands. The interior of the islands is either broad, low sand flats, 1 to 2 feet above sea level, with marshes and shallow lakes or vegetated beach ridges 5 to 15 feet above sea level. Some of the lakes are intermittently connected with Mississippi Sound or the gulf. Winds and currents from the east transport sand from the eastern ends to the western ends of the islands. The islands are more continuous than in the past indicating continuing reworking of relic sand sources from



Legend

- |                |                  |
|----------------|------------------|
| • Clay         | • Sand           |
| // Clayey Sand | ■ Sand/Silt/Clay |
| \\ Clayey Silt | » Silty Clay     |
| ⊘ Oyster Reef  | XX Silty Sand    |

Figure 2 Sediment Texture (from: US Army COE, 1984)



the continental shelf to the east. Erosion of the eastern ends of the islands and accretion on the western ends indicate considerable occurrence of longshore drift.

Surficial mapping of sediments indicates that the shelf source of sand is east of Mobile Bay, where the sand is continuous from the mainland to the shoal bottom (Shabica, 1978). The sands leave Mobile Point and enter the shoals of the submarine ebb-tidal delta south of the entrance into Mobile Bay. The sands are transported across the shallow northwest banks along the south shore of Dauphin Island. West of Dauphin Island, sands drift over a similar, but smaller ebb-tidal delta in Petit Bois Pass and continue westward.

The barrier island facies consist of well-sorted, medium-grained, mature quartzose sand containing less than 3 percent feldspar and having a mineral suite rich in staurolite and kyanite (Hsu, 1960 in Boone, 1973). The average width of the facies is 2.5 miles, with an average thickness of 40 feet.

Immediately south of the Mississippi Sound barrier island system is a nearshore fine-grained facies similar in lithology to that of Mississippi Sound. Movement of sediment from these estuaries forms a fine-grained facies which overlaps the Mississippi-Alabama sand facies in a zone about 7 miles wide south of the islands. Beach foreshore sand medians range between 0.33 to 0.56 millimeters (mm) on the north shores (lower energy, coarser sand) and between 0.21 to 0.40 mm on the south shores (higher energy, finer sand) of Horn and Petit Bois Islands. The textural inversion probably is due to the lesser amounts of fine sand available on the north beaches where the fine sand fraction is constantly moving. Because of the good sorting values, wave energies and sand supply appear to be in balance on both north and south shore beaches (Otvos, 1982).

The Mississippi-Alabama shelf is a triangular area, on the seaward side of the barrier islands, extending from the Mississippi River delta on the west to DeSoto Canyon south of Panama City, Florida, on the east. The shelf is about 80 miles wide in the west and narrows to about 35 miles in the east. The shelf is an extensive, almost flat plain bounded on the landward side by the relatively steep but narrow shoreface of the Mississippi Sound. The break in slope between shoreface and shelf occurs at a depth of about 20 feet along the barrier island system. A clayey silt/clay/clayey sand area exists south of Petit Bois Island possibly due to the fine-grained sediment from the east Pascagoula River entering the gulf via the existing 38 feet deep navigation channel, and flocculating/settling due to the higher saline gulf waters. This area appears to have a lower velocity regime compared to contiguous areas.

Sediment Chemistry. Although sediments may contain unusually high concentrations of metals and other constituents, this does not necessarily mean that the constituents will be released in the water column if disturbed. Many factors control their mobilization potential, including: salinity, particle size, clay mineralogy, pH, Eh, organic content, partitioning of

constituent within sediment, physical factors (winds, tides, storm events), bioturbation of sediment, etc. Thus, mobilization of constituents into the water column is a very complex mechanism. At present, no Federal or State criteria exist specifying allowable concentrations of constituents in sediments. However, knowing concentrations of constituents in sediments in conjunction with the factors affecting their release, determinations can be made whether additional testing is needed to further refine the impact of their release in the water column.

Because of their capacity to accumulate and retain pollutants in a manner that fluctuates little with time, sediments preserve an integrated record of past pollution events. In addition, the pollutants of more profound interest (pesticides, heavy metals, hydrocarbons), tend to accumulate in the sediments soon after they are discharged into the water (Lytle and Lytle, 1982). Sediment quality within the Pascagoula-Bayou Casotte area indicates localized highly polluted areas, including Lake Yazoo on the East Pascagoula River, the areas of the paper mill and pogy plant on the Escatawpa River, and the inner Bayou Casotte Harbor north of the Mississippi Chemical Company plant (Lytle and Lytle, 1982; 1983).

Petroleum hydrocarbons and other hydrocarbons occur at levels as high as 12,300 mg/g (or ppm dry weight) in surface sediments and 1,000 mg/g at 120 cm (4 feet) sediment depths in the inner harbor Bayou Casotte. In the regions of the bayou under consideration for deepening past dredging operations have removed most of the polluted sediments, and hydrocarbon levels range from 23.5 to 176 mg/g at the sediment surface (Lytle and Lytle, 1983). Levels of hydrocarbons in Mississippi Sound surface sediments are reflective of natural sources and materials related to shipping and fishery operations. Ranges from 6.37 to 69.7 mg/g have been recorded in the project area (Lytle and Lytle, 1983).

Heavy metals have been identified in surficial sediments in the navigation channels. Arsenic, iron, and lead levels are considered representative of polluted conditions. Chromium, nickel, and zinc are less abundant, while cadmium, copper, and mercury concentrations are very low (Table 2, Figure 3, GeoScience 1983).

Only trace amounts of DDD, DDE, and PCB's have been found in the sediments and the levels are felt to reflect the ubiquitous nature and worldwide contamination observed with these compounds. Bis (2-ethylhexyl) phthalate and Di-n-octyl-phthalate have been found in the sediments of the upper Pascagoula and Bayou Casotte channels (GeoScience, 1983). These phthalates, like PCB's and other chlorinated hydrocarbon pesticide residues, show a worldwide distribution and are used as plasticizers, primarily in the production of polyvinyl chloride (PVC) resins. No criteria have been established concerning contaminant levels in sediments.

Air Quality. Air quality for the entire State of Mississippi is considered good. The Pascagoula-Moss Point area is in total compliance with Mississippi State standards. Cloudiness tends to be highest in the winter

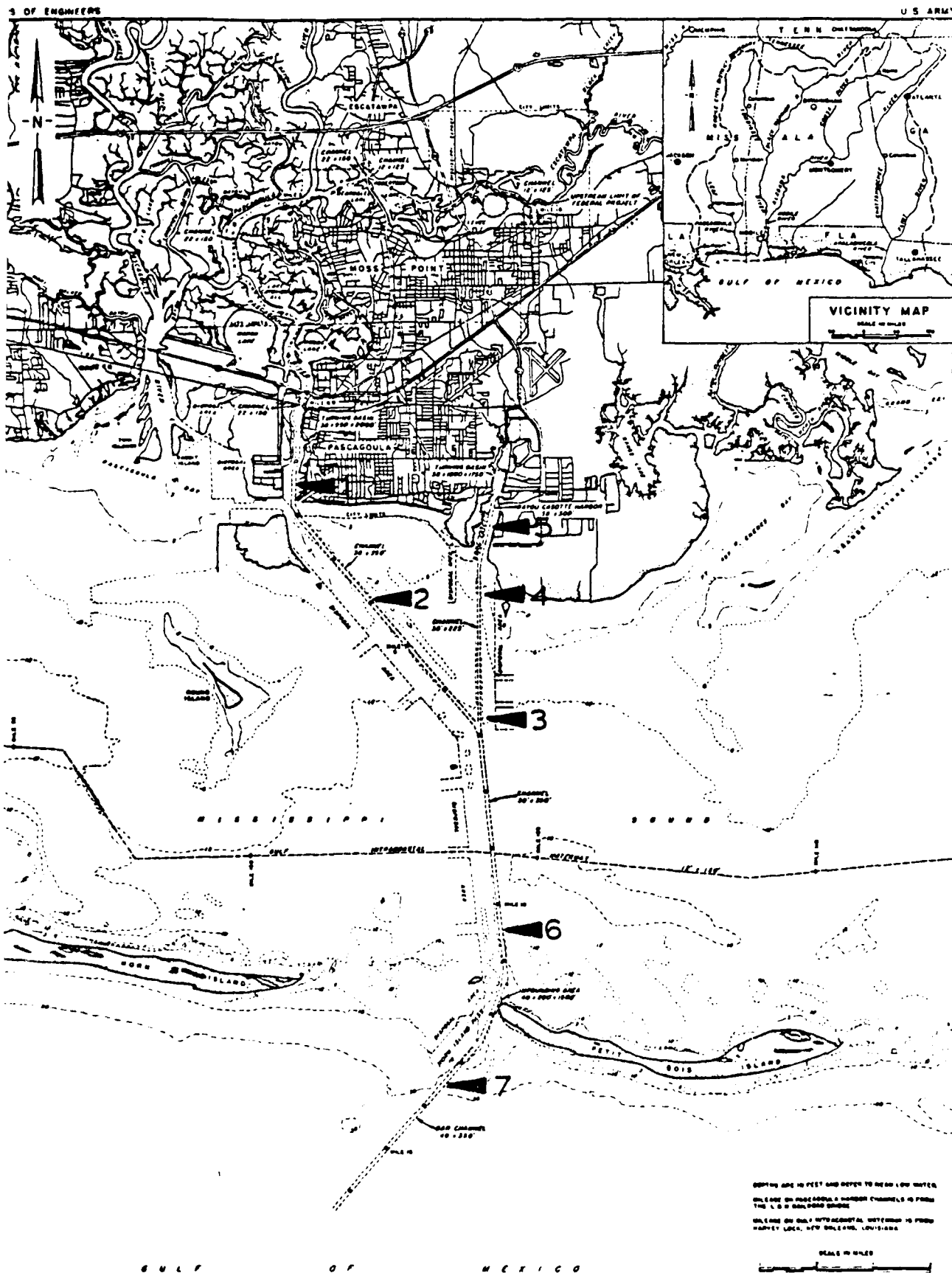


Figure 3 Sediment Quality Sampling Stations (from: GeoScience, 1983).

TABLE 2  
Sediment Heavy Metal Concentrations  
Pascagoula Navigation Channels, August 1983  
(Average Values in mg/kg)

Station	1	2	3	4	5	6	7
<u>Metal</u>							
Arsenic (As)	9.7	15.5	21	15.15	14.5	6.7	14.5
Cadmium (Cd)	0.2	0.15	0.13	0.3	0.75	0.06	0.15
Copper (Cu)	12.5	13	10.5	11	23	3	6
Chromium (Cr)	39	51.8	64.9	56.3	57.6	19.2	34.6
Mercury (Hg)	0.04	0.08	0.06	0.055	0.015	0.015	0.025
Iron (Fe)	2605	35500	40000	34150	28850	14350	24000
Lead (Pb)	61.4	62.85	73.5	83.8	146.5	26.5	42
Nickel (Ni)	16.5	23	28.5	21	17.5	7.5	15
Zinc (Zn)	89.5	111	120.5	113	136.5	32.5	64

and summer with lower values in the spring and fall. Much of the summer cloudiness consists of convective cumulus or high, thin clouds. Winter cloudiness is generally associated with movement of extra tropical cyclones and their associated frontal systems. Periods of low visibility from November through May correspond with heavy fog periods. Winter fogs are fairly frequent along the Gulf Coast as the large rivers and tributaries empty cold water into the warmer gulf waters. Heavy rains and high humidity during the summer are probably responsible for occasional low visibility.

Groundwater Resources. There are three main freshwater bearing aquifers in the coastal area of Jackson County. In ascending order, these aquifers are the Pascagoula, Graham Ferry, and Citronelle. Overlying these aquifers are terrace deposits and alluvium. There are no thick, consistent, traceable sand beds within the study area. Beds are irregular in both thickness and extent. Formations in these freshwater sections dip towards the south in Jackson County. The base of the freshwater zone varies from less than 1,000 feet to more than 2,000 feet below sea level in Jackson County (Baughman et al., 1976). Jackson County uses more than 50 MGD from ground water sources for municipal and industrial purposes.

Dissolved solids concentrations are variable and generally increase with depth. Some wells in Jackson County produce water approaching or slightly

eeding the maximum allowable concentration of 1.2 mg/l for fluoride. oride concentrations in excess of 250 mg/l are generally objectionable municipal water supplies. Chloride concentrations in water from the cagoula Formation, in the vicinity of Pascagoula, exceeds 300 mg/l and steadily increased over the years (Baughman et al., 1976). Increases chloride concentration are an indicator of saltwater encroachment in the a, resulting from heavy withdrawals.

Mississippi Bureau of Pollution Control (MBPC), 1982, has identified Pascagoula and Moss Point areas as having problems resulting from pumping. Water levels are declining in the Graham Ferry and Pascagoula formations, with the greatest declines in the vicinity of the City of Pascagoula. Heavy pumpage in Pascagoula and Bayou Casotte will perpetuate this condition. Salt water encroachment will be an increasing problem in the aquifers, as is now the case with the Pascagoula Formation in Pascagoula (Baughman et al., 1976).

The Mississippi Gulf Coastal Areas Study was initiated by the Mobile District Corps of Engineers in October 1983 for Hancock, Harrison, and Jackson counties in Mississippi. This study will address concerns about the deteriorating potable water supplies of coastal Mississippi and will develop information concerning the size of groundwater aquifers and other sources of water. The US Geological Survey will complete a report in September 1984 describing and documenting the occurrence and availability of surface water and groundwater.

Water quality is highly variable and dependent on several factors, including nonpoint and point source municipal and industrial loadings and their respective quality, rainfall and the associated high river discharge, degree of urbanization and concentration, and amount of dilution and/or mixing by the Pascagoula River. The Port of Pascagoula area, comprised of the Escatawpa River to Mile 10, the east and west Pascagoula Rivers to Mile 10 below the confluence with the Escatawpa River and Bayou Casotte, is recognized to have one of the worst water quality problems within the State of Mississippi. This heavily industrial area contributes 60 million gallons per day (MGD) municipal and industrial discharges to the surface waters.

All streams within this area are classified for use by fish and wildlife. The State of Mississippi has recognized the severity of the problem on the Escatawpa River near Moss Point by reducing the dissolved oxygen (DO) standard from 5.0 mg/l to 3.0 mg/l (Mississippi Bureau of Pollution Control, 1982). Bayou Casotte has been recognized by the State of Mississippi as having DO and bacteria problems related primarily to the Pascagoula/Bayou Casotte Sewage Treatment Plant. A new wastewater treatment plant is under construction for the Pascagoula/Bayou Casotte area which should relieve the problems mentioned above. Within the study area, Mississippi Sound is classified for recreational use and shellfish harvesting, except in an area along the mainland from Point aux Chenes Bay to west

of the West Pascagoula River and the area around the navigation channels which are closed to shellfish harvest (Figure 4).

Nutrient, heavy metal, pesticide, and hydrocarbon concentrations in the waters of the study area have not been reported in excess of Environmental Protection Agency (EPA) or State of Mississippi water quality standards.

Dissolved oxygen concentrations within the sound typically vary between 7 mg/l to 12 mg/l (saturation) during the spring, and between 6 mg/l to 12 mg/l during the summer (Eleuterius, 1979), reflecting dilution of the various oxygen demanding wastes entering the sound.

Salinity values within the study area are highly variable. During spring high freshwater inflow periods, salinities vary between 1 and 29 parts per thousand (ppt) with a general decreasing trend from east to west in Mississippi Sound. The summer lower inflow period can range between 5 to 29 ppt exhibiting the same decreasing trend as the spring. The system is well-mixed throughout the water column except within the navigation channels (Kjerfve, 1983). Salinities in the nearshore Gulf of Mexico are more oceanic in nature ranging around 29 to 35 ppt with stratification being temporarily variable.

Data collected during July 1981 (low freshwater discharge) at 4 locations within the same area reflected a slightly stratified system. Water depths varied between 40 to 52 feet with surface salinities ranging between 29.6 to 30.7 ppt and bottom salinities ranging between 34.4 to 35.3 ppt. Each location varied approximately 4.8 ppt from surface to bottom. Surface temperatures ranged between 30.6 C to 31.7 C and bottom temperatures ranged between 25.2 C to 27.0 C, with each location varying approximately 5 C from surface to bottom.

Bottom DO values were collected at 6 locations south of Horn Island during November 1980 and March 1981. The concentrations varied between 5.5 mg/l and 6.6 mg/l during the fall and 6.4 mg/l and 7.6 mg/l during the spring (US Army Corps of Engineers, 1982).

Nutrient data are limited within the gulf. Eleuterius (1972) collected nutrient data at two locations south and southeast of Horn Island at the 10 fathom contour between June 1968 to May 1969. Nutrient concentrations throughout the water column were generally the same throughout the year ranging between .01 mg/l to .2 mg/l. Orthophosphate concentrations were slightly higher during the low freshwater discharge period. Concentrations varied between .01 mg/l to .04 mg/l.

Dissolved metal, pesticide, polychlorinated biphenol (PCB's), and high molecular weight hydrocarbon data were collected by Harmon Engineering and Testing (1983) at two areas approximately 3 miles southeast of the east end of Horn Island during April 1983, mercury concentrations were 0.0003 mg/l for both stations, cadmium concentrations were 0.0018 mg/l and 0.0017 mg/l, lead concentrations were 0.012 mg/l and 0.0045 mg/l, and copper

Table 9

MISSISSIPPI  
JACKSON COUNTY

EMPLOYMENT BY INDUSTRY, SELECTED YEARS, 1969-2040 (TOTAL NUMBER OF JOBS)

	1969	1978	1985	1990	1995	2000	2010	2020	2030	2040
TOTAL EMPLOYMENT	33194	54198	60314	65027	68595	72967	79474	82222	84429	87103
AGRIC. PRODUCTION	240	206	179	164	155	145	132	121	112	104
AGR. SVCS., F., & F.	495	169	137	126	119	118	119	118	118	118
MINING	54	59	50	44	38	34	28	25	23	21
CONSTRUCTION	2620	3831	4949	5725	6139	6557	7104	7268	7415	7565
TOTAL MANUFACTURING	15505	27351	27138	28027	28939	30218	32327	33329	34172	35941
NONDURABLE GOODS	4038	4702	5387	5822	6179	6578	7204	7489	7706	7932
FOOD & KINDRED			969	982	991	991	980	983	981	979
TEXTILES			0	0	0	0	0	0	0	0
PAPER & ALLIED			(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
CHEMICALS & ALLIED			1005	1114	1199	1313	1481	1555	1616	1679
PETROLEUM REFINING			(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
DURABLES	11467	22649	21751	22205	22760	23640	25123	25840	26466	27108
STONE, CLAY, & GLASS			(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
PRIMARY METALS			(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
NON-ELECTRIC MACH.			153	218	270	324	403	443	473	505
ELECTRIC MACH.			(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
TRANSP., COMM., & P.U.	827	1124	1313	1442	1536	1658	1827	1899	1957	2017
WHOLESALE TRADE	483	1025	1320	1496	1626	1784	2002	2096	2173	2253
RETAIL TRADE	3255	5964	7598	8576	9258	10039	11177	11565	11921	12288
FINANCE, INS., & R.E.	659	1447	1999	2330	2575	2880	3313	3528	3713	3908
SERVICES	3896	5696	7058	7924	8653	9502	10796	11404	11955	12533
TOTAL GOVERNMENT	5160	7326	8573	9173	9557	10032	10649	10869	11061	11257
FEDERAL CIVILIAN	408	657	808	873	913	957	1015	1041	1061	1081
FEDERAL MILITARY	1133	1323	1354	1354	1354	1354	1354	1354	1354	1354
STATE AND LOCAL	3619	5346	6411	6946	7290	7721	8280	8474	8646	8821

## TABLE NOTES

(D) NOT SHOWN TO AVOID DISCLOSURE OF CONFIDENTIAL INFORMATION, DATA ARE INCLUDED IN HIGHER LEVEL TOTALS.

PROJECTED TWO-DIGIT EMPLOYMENT DATA IN MANUFACTURING ARE SHOWN ONLY FOR SELECTED INDUSTRIES, THEREFORE THEY WILL NOT ADD TO TOTAL DURABLE EMPLOYMENT AND TOTAL NONDURABLE EMPLOYMENT. HISTORICAL TWO-DIGIT MANUFACTURING EMPLOYMENT DATA ARE PRESENTLY UNAVAILABLE FOR PUBLICATION.

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REGIONAL ECONOMIC ANALYSIS DIVISION

pulation base will settle in unincorporated areas in larger numbers than the cities of Moss Point, Ocean Springs, or Pascagoula. Per capita income will rise correspondingly up to 338 percent above the 1978 figure by the year 2040. The major portion of income growth should occur between the 78 and the end of the century.

Table 9 shows, manufacturing will continue to be the dominant source of employment during the next 60 odd years. By the year 2040, it will account for 40.2 percent of all jobs held. This represents a slight decrease from the 1978 percentage of 50.7. That decrease apparently will be due to a gradual expansion in other sectors such as trade, services, finance, insurance, and real estate, and non-Federal government offices. In contrast, the total number of jobs is expected to increase by 60.7 percent between 1978 and 2040.

Estimates of the future significance of harbor-related industries indicate their continued importance. Assuming that the manufacture of transportation equipment (SIC 37) remains stable, it will combine with the production of paper and chemicals to total approximately 80 percent of all manufacturing employment.

Future Project Conditions. Navigation in Pascagoula Harbor utilizes widths and depths in the existing deep-draft project which are inadequate for the size vessels now calling at the port. The tankers transporting crude oil to Bayou Casotte and the bulk carriers exporting grain from the elevator on the Pascagoula River have been steadily increasing in average size, although this process obviously cannot continue indefinitely. Many of the vessels calling at the port are either lightloading or waiting on the tide to move through the existing channels. Inadequate channel and turning basin dimensions in Bayou Casotte could lead to hazardous situations where the larger vessels are involved. The large volumes of flammable materials moving through the harbor render such a situation hazardous to both life and property. Construction of the Tenneco LNG terminal and initiation of LNG export will result in an even larger volume of flammable material entering Bayou Casotte. Since the present turning basin is at the upper end of the Bayou channel, tankers have to unload and move empty for about a mile through a busy industrial area to be turned and brought back to the mouth for departure. In addition, local pilots contend that the open sea conditions and rapid shoaling of the channel at the west end of Petit Bois Island are such that grounding is a hazard in navigating the channel.

Maintenance of the existing navigation project at Pascagoula requires periodic dredging and disposal of dredged materials. Finding adequate disposal areas for dredged materials that are not environmentally damaging is becoming increasingly difficult and will continue to be a major problem, both with and without future harbor improvements. However, implementation of the recommendations developed from this study and others may alleviate the situation somewhat.

Future Environmental Conditions. Prior to the late 1960's, wetlands were filled indiscriminately for the purpose of residential, industrial, and commercial development. The construction of the Pascagoula and Bayou



Louisville and Nashville Railroad Depot, Pascagoula, MS.  
 Front Street Historic District, Pascagoula, MS.  
 Louisville and Nashville Railroad Depot, Ocean Springs, MS.  
 Pascagoula Central Fire Station No. 1, Pascagoula, MS.  
 Griffin House, Moss Point, MS.

# CONDITIONS IF NO FEDERAL ACTION IS TAKEN

Future Socioeconomic Trends. Projections of increases in population and of economic growth are based on historical figures statistically extended through time. Such computations, therefore, will not reflect changes which may result from construction and operation of the proposed project. Population changes due to expansion of the economy are likely to be minimal, however, as workers can commute easily from other counties. Given the likelihood of a non-residential segment of the workforce, the data presented in this section should be considered as reasonably accurate.

TABLE 8  
 Selected Projections for Jackson County

YEAR	TOTAL PERSONAL INCOME <u>1/</u>	PER CAPITA INCOME <u>2/</u>	TOTAL EARNINGS <u>1/</u>	EMPLOYMENT	POPULATION
1978	479,821	4,121	485,432	54,198	116,440
1985	618,030	5,042	631,407	60,314	122,574
1990	753,208	5,880	770,419	65,027	128,105
1995	893,950	6,708	910,989	68,595	133,273
2000	1,070,168	7,724	1,093,746	72,976	138,550
2010	1,463,779	9,861	1,488,899	79,474	148,445
2020	1,896,764	11,960	1,898,900	82,222	158,591
2030	2,438,090	14,711	2,411,397	84,620	165,738
2040	3,133,907	18,093	3,062,703	87,103	173,207

1/ In thousands of 1972 \$.

2/ In 1972 \$

SOURCE: U. S. Department of Commerce, Bureau of Economic Analysis,  
 Regional Economic Analysis Division, December 1982. County Level  
 Projections of Economic Activity and Population.

As Table 8 indicates, by the year 2040, the total population of Jackson County is expected to reach about 173,000. This represents an increase of 55,000 persons or 46.8% from the 1980 decennial count. Such a percentage means a slower rate of growth during the next 60 years than shown over the previous two decades. According to several sources, the expanding

warrant further investigation. There remain, however, 46 potentially significant vessels reported lost that may lie within the study area.

Research on the geomorphology of Mississippi Sound in the vicinity of Pascagoula revealed that the potential for undisturbed submerged prehistoric cultural resources is low. The rise of sea level between 15,000 and 6,000 B. P. and associated coastal erosional processes would have substantially altered any human occupation sites under the present day waters of the Sound.

A fifteen percent (15%) sample of each of the 34 alternate upland disposal areas was inspected during the 1983 investigations. As a result of the terrestrial reconnaissance, it is considered that the alternate areas under consideration bear little potential for containing significant cultural resources. The proposed areas are for the most part poorly suited for permanent human habitation due to low elevation and poor drainage. One exception is noted on Greenwood Island (Alternate Area A) where two (2) archeological sites, 22 Ja 516 and 22 Ja 618, containing intact prehistoric and historic cultural components are located. These sites are potentially eligible for inclusion on the National Register of Historic Places. Other previously recorded prehistoric archeological sites, 22 Ja 537, 22 Ja 523, and 22 Ja 522 were found to have been destroyed by shoreline erosion.

During the marine portion of the reconnaissance, over 260 miles of survey lines were run. Equipment employed included marine proton precession magnetometer, side-scan sonar, microwave positioning system, and survey fathometer. A total of 501 magnetic anomalies were recorded during the survey. However, correlation of magnetic data with sidescan imagery revealed that most of the anomalies were in fact produced by cable, pipe, or other modern ferrous debris. Seven clusters of anomalies containing a total of 53 targets and 6 individual anomalies were recommended for additional identification and evaluation along the channel segments of the project. Four (4) individual anomalies in the alternate open water disposal sites were recommended for further study.

The report of the 1983 cultural resources investigations was submitted to the Mississippi State Historic Preservation Officer and the National Park Service, U. S. Department of Interior for review and comment. Comments of both of those agencies are on file in the Mobile District.

Review of the National Register of Historic Places revealed that the following properties in Jackson County, Mississippi, are currently listed. No nominations are pending at this time. Further, none of the eight (8) properties listed occur within the limits of the Pascagoula Harbor project and none will be affected by the proposed improvements. The properties are as follows:

Old Spanish Fort (Old French Fort), Pascagoula, MS.  
Colonel Alfred E. Lewis House, Gautier, MS.  
De Groote Folk House, Hurley, MS.

Commodity groups handled by the port include rubber, metallic ores, coal, petroleum, nonmetallic minerals, grain and grain products, lumber and wood products, chemicals and allied products, and primary metal products.

Industrial and port activities are not the only notable factors in the economy of Jackson County. Fishing, forestry, and agriculture still maintain an important position. The Mississippi Sound is part of the Gulf Fisheries Fertile Crest, one of the world's most productive fishing grounds. Commercial salt water fisheries yield such fish and shellfish as shrimp, oysters, crab, kingfish, sea trout, mullet, flounder, and menhaden. Approximately 80 percent of the county is covered by pine forest, especially slash and long leaf pine. Much of this area is dedicated to commercial timber production, and over 50 square miles are overlain by DeSoto National Forest. Three major commercial timber companies own 21 percent of the county. Once the world's leading exporter of lumber, local sawmills have given way somewhat to wood products-type industries. Although Jackson County is well suited for agricultural production, in recent years the number of farms has been decreasing. Conversely, the size of the individual farm has been increasing. Crop farming, livestock, dairy, poultry, fruit, and nut production have been the most significant agricultural industries.

Indicators of a healthy, diversified economy notwithstanding, approximately 11.3% of resident families received incomes considered at or below poverty level. For those 2,469 households, the mean income was \$2,197 in 1970. This contrasts sharply with a median income of \$8,545 for the entire county, one of the highest in the State.

#### CULTURAL RESOURCES

Within the Pascagoula Harbor study area, several types of submerged and terrestrial cultural resources are anticipated to exist. These include prehistoric and historic archeological sites, historic shipwrecks, cargo associated with shipwrecks, military fortifications, and other structures. In March 1983 cultural resources investigations for this study were initiated. The purpose of these investigations was to identify the potential for submerged and terrestrial prehistoric and historic cultural resources in areas that will be affected by construction of the Pascagoula Harbor improvements. Work performed in 1983 included archival research on the prehistory and history of the study area, reconnaissance level investigation of 34 alternate upland disposal sites, and underwater remote sensing survey of the navigation channels and alternate open water disposal sites in Mississippi Sound.

A total of 118 vessel losses were identified for the vicinity of Pascagoula and the adjacent waters of Mississippi Sound. Of these, 46 have been documented as salvaged, blown on shore, dismantled and removed from the study area, or are located outside of areas where construction activities will occur. An additional 26 vessels were built after 1934 and do not

Table 7

DIRECT AND INDIRECT  
ECONOMIC IMPACT OF THE  
PORT OF PASCAGOULA  
MISSISSIPPI AND JACKSON COUNTY: 1975

Industry	Mississippi		Jackson County	
	Employment	Wages (1,000)	Employment	Wages (1,000)
Port service industry				
Jackson County Port Authority (including its licensees)	750	\$ 9,300.0	588	\$ 7,350.0
Government agencies	60	700.0	48	560.0
Inland transportation services				
Rail	130	1,800.0	100	1,385.0
Marine	1,935	30,000.0	284	4,403.0
Highway	25	237.0	20	190.0
Port-induced industry				
Ingalls and Ingalls' subcontractors	26,430	237,000.0	15,065	135,089.0
Mississippi Chemical Corporation	600	7,500.0	360	4,500.0
Chevron U.S.A., Inc.	700	10,500.0	528	7,920.0
First Chemical Corporation	80	1,500.0	64	1,200.0
Corning Glass Works	295	3,600.0	236	2,880.0
Total direct impact	31,005	\$302,137.0	17,293	\$165,477.0
Total indirect impact	31,005	192,763.0	17,293	105,574.0
TOTAL IMPACT	62,010	\$494,900.0	34,586	\$271,051.0

Source: Mississippi Research & Development Center (1977), Economic Impact of the Port of Pascagoula on Jackson County and the Surrounding Area, Jackson, Mississippi.

TABLE 6

Comparison of Ingalls Employment to Labor Force,  
Jackson County, 1970-1977

YEAR	INGALLS EMPLOYMENT	COUNTY LABOR FORCE	RATIO OF INGALLS EMPLOYMENT TO TOTAL COUNTY LABOR FORCE
1970	9,782	29,850	33%
1971	12,300	31,780	39%
1972	15,500	36,130	43%
1973	18,100	48,630	37%
1975	19,400	46,640	42%
1977	25,100	54,240	46%

SOURCES: Ingalls Shipbuilding; Mississippi Employment Security Commission; and Hammer, Siler, George Associates, as quoted in "Economic Adjustment Program, Jackson County, Mississippi," Office of Economic Adjustment, The Pentagon, Washington, DC, September 1978.

Continuing to use the one index given above, and adding the employment multiplier of .4 to .5 (Construction Engineering Research Laboratory, Computer Printout, 1975 Data), employment generated by the major shipbuilding firm ranges between 10,000 and 12,500 for every 25,000 persons employed by Ingalls, or from 2 to 5 jobs for every 10 "export" jobs (Ingalls). Another recent study estimates that the direct/indirect ratio of Ingalls ("export") employment and employment in supporting businesses is 1 to 1 (the U. S. Department of Housing and Urban Development, Jackson, Mississippi, Area Office, April 1978). Table 7 gives more specific data for both county and State benefits from the Port of Pascagoula.

Port Facilities at Pascagoula Harbor, Mississippi, are used to move a variety of cargo to/from most regions of the United States. Analysis of the 19 States served indicates that States utilizing the port extend from New Mexico in the western United States to New Jersey on the Atlantic Ocean. The following tabulation shows those various States by region of the Country.

STATES, BY REGION, USING PASCAGOULA HARBOR

EAST	MIDWEST	SOUTHEAST	WESTERN
New Jersey	Illinois	Alabama	Colorado
	Indiana	Florida	Kansas
	Iowa	Georgia	Louisiana
		Mississippi	Minnesota
		Tennessee	Missouri
			Nebraska
			New Mexico
			Oklahoma
			Texas
			Wisconsin

TABLE 5

## Employment Trends, Jackson County, 1961-1977

INDUSTRY	1961	1970	1977	1961-1977 CHANGE		
				NUMBER	PERCENT	AVERAGE ANNUAL
Construction	650	3,160	3,390	2,740	421.5%	10.9%
Manufacturing	8,340	15,940	30,890	22,550	270.4%	8.5%
TCU 1/	470	700	910	440	93.6%	4.2%
Trade	1,770	3,350	6,030	4,260	240.7%	7.9%
FIRE 2/	190	560	980	790	415.8%	10.8%
Services & Mining	970	2,280	3,550	2,580	266.0%	8.4%
Government	1,580	3,670	5,730	4,150	262.7%	8.3%
Other 3/	2,300	2,610	2,700	400	17.4%	1.0%
Agriculture	710	250	250	-460	-64.8%	-6.3%
TOTAL	16,980	32,520	54,430	37,450	220.6%	7.5%

NOTES: 1/Transportation, Communication, and Utilities.

2/Finance, Insurance, and Real Estate.

3/Includes domestic household workers and self-employed persons.

SOURCES: Mississippi Employment Security Commission, and Hammer, Siler, George Associates, as quoted in "Economic Adjustment Program, Jackson County, Mississippi," report prepared by the Office of Economic Adjustment, Office of the Assistant Secretary of Defense, September 1978.

Employment attributable to the harbor is principally export related. Employment is graphically portrayed in Table 6, showing the dominance of Ingalls Shipbuilding for the labor force of the entire county. Ingalls Shipbuilding moved to Pascagoula in 1938 from the Mobile Area. Expansion at the West Bank began in 1961 with assistance from both the State and the county. Mississippi issued industrial development bonds, granted tax exemptions, and contributed \$4 million in site improvements. Jackson County also invested \$1 million in site improvements. Continuing aid in recruitment was provided by the State Employment Security Commission. In 1977, Ingalls provided roughly 25,100 jobs--46 percent of the county's total--as well as support for many jobs in industries such as trade and services. Table 4 below shows one index--the employment/labor force ratio--of the importance to the Jackson County economy of the direct employment at Ingalls Shipbuilding.

TABLE 4

## Land Use - Jackson County

TYPE	1970 ACRES	% COUNTY	1972 ACRES	% COUNTY
Residential	9,756	2.11	11,327	2.45
Commercial	963	0.21	925	0.20
Industrial	4,797	1.04	5,178	1.12
Public & Semi-Public	6,189	1.34	6,334	1.37
Rights-of-Way	10,127	2.19	10,310	2.23
Resource Production (Agriculture, Forest)	148,692	32.19	147,671	31.94
Water, Undeveloped, Other	281,814	60.95	280,593	60.69
TOTAL AREA:	462,338	100.03*	462,338	100.00

\*Not equal to 100.00% due to rounding.

SOURCE: Regional Land Use Plan for Hancock, Harrison, Jackson, and Pearl River Counties, Gulf Regional Planning Commission, 1971 and 1973, as quoted in "Economic Profile of the Mississippi Sound Study Area," June 1978, prepared by John H. Friend, Inc., for U. S. Engineer District, Mobile, Alabama, page 134.

Economic Characteristics. The economy of Jackson County is, and has been, dominated by manufacturing, as shown in Table 5. In 1970, 49.0 percent of the total employment was in the manufacturing sector. Figures for 1977 show manufacturing employment to have increased to 56.8 percent.

As of 1977, shipbuilding, chemicals, paper, and marine resources (including seafood products) were the most important manufacturing industries in Jackson County. Although Ingalls remains the primary employer in the county, by 1977, more than 6,000 persons were employed by manufacturing industries other than shipbuilding. Furthermore, between 1970 and 1977, 30 new businesses from outside the county were opened in Jackson County. These firms include four new boat building and repair firms and two new each in metal coating, optical instruments and lenses, meatpacking, paving mixtures, and millwork. According to the 1978 report of the Office of Economic Adjustment, major attractions for business locations in Jackson County are: linkages to shipbuilding (i.e., Ingalls) and other industries; availability of water and skilled labor; access to the Gulf of Mexico; and sizable growth in both private and public construction investments. Considering the above factors and the specific locations of major industries shown in Figure 5, the importance of the harbor in the county's socio-economic system cannot be underestimated.





TABLE 3  
Jackson County Population Trends

Location	1950	1960	1970	1980
Jackson County	31,401	55,522	87,975	118,015
Moss Point	3,782	6,631	19,321	18,998
Ocean Springs	3,058	5,025	9,580	14,504
Pascagoula	10,805	17,155	27,264	29,318
Unincorporated	13,756	26,711	31,810	55,195

SOURCES: County and City Data Books, 1952, 1967, 1977. Bureau of Census, U. S. Department of Commerce; Census of Population and Housing, 1980: Summary Tape File 1A Microfiche Technical Documentation, Bureau of Census.

A highly industrialized area, shown in Figure 5, is located along Bayou Casotte to the east of the City of Pascagoula. Seafood, shipbuilding, and boatbuilding industries are located along the banks of the Pascagoula River near its mouth. Fish meal, chemical, boatbuilding, and paper industries are located along the Escatawpa River from its mouth to River Mile 8.

Public or semi-public land holdings within Jackson County include: DeSoto National Forest (50 square miles in the western portion of the county), Red Creek Game Management Area (in northwestern Jackson County, 125 square miles), Pascagoula River Game Management Area (on the Pascagoula River from Central Jackson County into George County in the north), Gulf Island National Seashore (between Ocean Springs and Pascagoula, including Horn and Petit Bois Islands National Wildlife Refuges (barrier islands), Mississippi Sandhill Crane National Wildlife Refuge (2,226 acres near Fontaine Bleau and Ocean Springs) and 16th section land (8,320 acres).

As Table 4 below indicates, Jackson County is becoming more urban in character. The rural farm population is estimated at 0.5 percent and decreasing. In 1978, about 85 percent of the county residents were served by public water systems. Projections for the year 2030 show nearly 100 percent of the county being served by public water. Land use data more recent than 1972 are not available; hence, present usage patterns may be substantially different than those shown for the years 1970 and 1972.

the Sound between Biloxi and Mobile Bay. North/south wind components have small, localized, erratic effects on water velocities.

Wave intensity on the Mississippi-Alabama shelf is low to moderate with wave periods ranging from three to eight seconds and wave heights rarely over 7 feet. However, hurricane or storm conditions may produce larger waves.

## SOCIAL ENVIRONMENT

Demographic Characteristics. In 1980, Jackson County had a population of 118,015 persons. This total represented a 34.1 percent increase over the 1970 figure of 87,975. More impressively, in the two decades ending in 1980, the county's population more than doubled, from a 1960 total of 55,522. There was a corresponding rise in population density, from 75.4 persons per square mile in 1960 to 160.3 in 1980; this rise was most evident along the coastline where the majority of the county's population resides.

Each of the three incorporated communities of Jackson County, Moss Point, Ocean Springs, and Pascagoula, reflects the growth characteristics of the county. While Moss Point had the largest percentage increase in population during the period 1960-1970 (191.1%), Pascagoula had the smallest (59.1%). In between was Ocean Springs with a 90.6 percent growth rate. Between 1970 and 1980, however, Moss Point experienced a decrease of 1.7 percent, while Ocean Springs grew at a 51.4 percent rate. Pascagoula also grew, but at the slower rate of 7.5 percent.

The unincorporated areas of Jackson County accounted for a substantial portion of the population, 36.2 percent in 1970 and 46.8 percent in 1980. Because of Census definitions, however, residents in unincorporated areas can be classified as "urban"; thus, the county has become increasingly defined as urban even though more residents are settling outside of corporate limits. The share of county residents living in urbanized areas rose from 61.3 percent in 1960 to 71.6 percent in 1970. At the time of the 1980 Census, 77.9 percent of the residents were classified as urban. Table 3 displays selected historic population totals for Jackson County.

Land Use and Urban Development. As a whole, Jackson County is sparsely developed, although highly concentrated development occurs along the coastline. In fact, development in the county has taken place almost exclusively along a 10-mile-wide strip extending along the Coast. This area is crossed by U. S. Highway 90 (E-W), a coastal route; I-10 (E-W) to the north of the incorporated cities of Pascagoula, Moss Point, and Ocean Springs; and State Highway 63 (N-S) which connects the highly industrialized area in East Pascagoula at Bayou Casotte with other highways. In addition to the three incorporated cities, unincorporated areas lie between Pascagoula and Ocean Springs. Growth in residential development, including many new subdivisions, extends to the north and east from each of these cities.

concentrations were 0.003 mg/l and 0.0065 mg/l. No pesticides or PCB's were detected at either station. A few aliphatic compounds, primarily n-alkanes were detected. No aromatic hydrocarbons were detected.

Circulation patterns within the study area are controlled by astronomical tides, winds, and freshwater discharges. The patterns within the immediate study area are better understood when they are grouped with the overall circulation patterns of the Mississippi Sound and the adjacent gulf waters (USACE, 1984).

In Mississippi Sound and the adjacent gulf waters, the average tidal range is 1.5 feet with a predominant diurnal period of 24.8 hours. The tidal wave progresses from south to north and enters the sound first through Horn Island Pass near Pascagoula and splits traveling both eastward and westward causing as much as a 6-hour phase shift within Mississippi Sound. The eastward progressing high water reaches Pass aux Heron approximately one hour after entering the sound. The westward progressing high water reaches Lake Borgne approximately two hours after entering the sound.

The effect of the wind on circulation patterns is significant. The superimposed wind-induced current on the sound shifts the bifurcation area at Horn Island Pass either toward the east or west. This eastward or westward movement of the bifurcation area depends on the east/west wind component and phase of the tide. A wind with an eastern component induces a general westward current in the sound causing the bifurcation area to shift to the east (Petit Bois Pass) during the flood tide and to the west (Dog Key Pass) on the ebb tide. Winds with a western component set up a general eastward circulation pattern in the Sound. The eastward movement of water forces a bifurcation further to the west at Ship Island Pass on flood tide and a split at Petit Bois Pass on the ebb tide. Winds with dominant north and south components have a minimal effect on overall circulation patterns. These wind components cause the development of eddies or vortices within the shallower areas of the Sound tending to disrupt and diffuse tidal currents. These eddies occur mostly in the area between Dog Keys Pass and Mobile Bay and are strongest in the eastern half of the Sound.

Freshwater inflows have a negligible effect on the overall circulation patterns as induced by the tides and winds. Comparison of high inflow conditions to low inflow conditions show the same general circulation patterns with an increase in velocities during high freshwater inflow (Corps of Engineers, 1983).

Water velocities range between 0 to 3 feet per second (fps) in the barrier island passes and between 0 to 0.8 fps in the Sound. The region west of Biloxi and east of Petit Bois Pass have the higher velocities, while velocities near the Pascagoula area are the lowest. Generally, peak velocities throughout the sound increase by 40 percent per one foot increase in the tidal range. The east/west wind components tend to increase velocities in

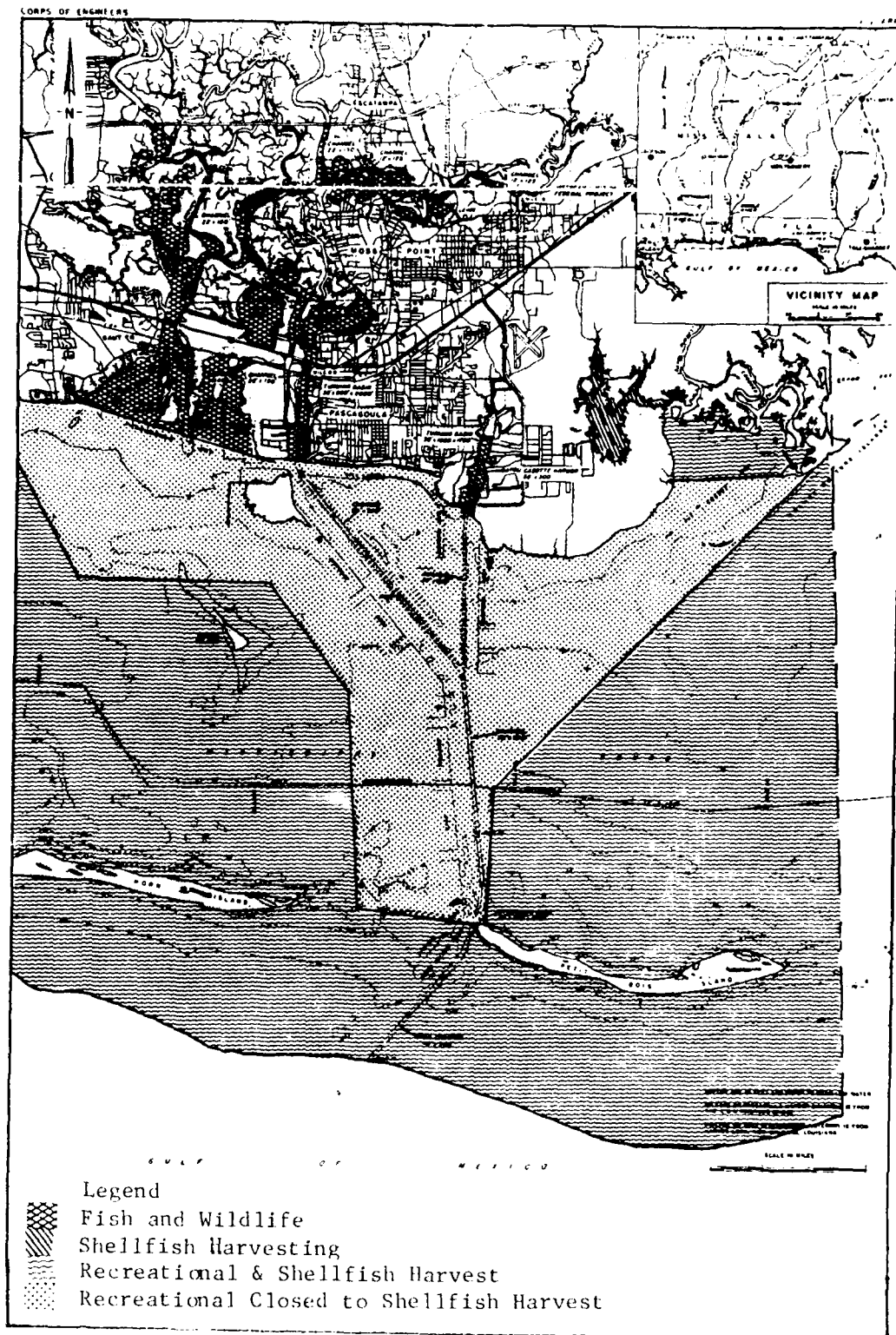


Figure 4 State Water Use Classification.

Casotte industrial areas resulted in the dredging and filling of approximately 5,000 acres of saline, brackish, and freshwater wetland habitats. With the implementation of the National Environmental Policy Act in 1969 and amendments to the Federal Water Pollution Control Act in 1972 (Clean Water Act) this indiscriminate dredging and filling of wetlands has been curtailed. In addition, the passage of the Coastal Zone Management Act encouraged the State governments to implement land use plans for coastal areas; the State of Mississippi's Coastal Zone Management Plan was approved in 1980. As part of Mississippi's plan, the State regulated the type of use approved for areas of the coastal zone and instituted the concept of special management area planning for specific areas within coastal Mississippi. The Special Management Area (SMA) plan for Pascagoula is aimed at the protection or enhancement of wetland resources within the Pascagoula management area. This plan, when approved, will delineate areas for development, preservation, enhancement, restoration, and creation of wetlands. The plan will also establish a mitigation policy for development within the Pascagoula SMA. Without the Federal project, the SMA plan will serve to protect the valuable wetland resources within the area. Some wetlands will ultimately be converted to other uses, especially in the case of water dependent industries; however, the SMA will require that these wetlands be compensated for in order to maintain the productivity of the system.

The fishery resources of the Pascagoula area are highly variable and are dependent upon the environmental state of the entire area of Mississippi Sound, the land areas adjacent to Mississippi Sound and the nearshore region of the Gulf of Mexico. Fishery landings and values fluctuate in response to weather, fishing pressure, and the economic environment of the fishing industry, including the cost of fuel, number of vessels, and value of the catch. Jackson County, primarily the ports of Pascagoula and Moss Point, receives greater than 85% of all Mississippi landings, including all industrial fish (menhaden), 95% of the mullet, trout, and red snapper, and 74% of the croakers landed. Over the past six years the total landings through the ports of Pascagoula - Moss Point and their value have shown this variability (Table 10). The fishing vessels utilizing the ports of Pascagoula and Moss Point would not be impacted by the lack of a deepened or widened channel and without the Federal project, the industry should continue to flourish and show the fluctuating trends shown in the past.

The wildlife resources of the mainland area would continue to be restricted due to the highly urban and industrial nature of this area of Jackson County. Wildlife utilizing the barrier islands will continue to flourish due to the protected status of these areas as part of the Gulf Islands National Seashore. It is assumed that the current trends in endangered red and threatened species would continue to occur without the Federal project.

Without the Federal project, the water quality within the Pascagoula area would tend to remain the same in some areas, improve in other areas, and

TABLE 10

Fishery Landings and Value  
Pascagoula - Moss Point Mississippi

YEAR	LANDINGS (in millions of pounds)	VALUE (millions of dollars)
1978	334.8	19.4
1979	283.8	18.1
1980	291.9	18.9
1981	220.5	16.8
1982	331.6	18.5
1983	380.2	23.2

degrade in other areas. The passage of the amendments to the Federal Water Pollution Control Act (Clean Water Act) in 1972 instituted the National Pollution Discharge Elimination System (NPDES) under which discharge permits are granted by the State with Environmental Protection Agency (EPA) approved programs. Any discharges by point sources, except in compliance with the limitations imposed in a permit, are declared unlawful. The State of Mississippi operates under this system. In addition, the concepts of best management practice (BMP) and best available technology (BAT) are applied to industrial areas for control of discharge and runoff from industrial sites. These regulations will help to improve the quality of water within the industrial areas of Pascagoula and Bayou Casotte in the future.

The upgrading of sewage treatment facilities, such as the Frederick Street facility, will also help to improve the quality of the water in the area. The provision of additional facilities in the future, with the ultimate aim of reducing the number of individual septic systems within the area, will help to improve the fecal coliform levels which currently restrict oyster harvest in the area.

Open water disposal of dredged materials within sites in Mississippi Sound, as is practiced with the currently authorized Federal project for Pascagoula Harbor, will continue to result in localized increases in turbidity and nutrients and decreases in dissolved oxygen within the water column. Return of water from existing diked disposal sites would also continue to cause temporary localized increases in turbidity and nutrients and decreases in dissolved oxygen within the immediate vicinity of the outfall. Short term localized effects of this nature would continue to occur at the dredge cutterhead during maintenance dredging operations. Results of the Waterways Implicit Flooding Model (WIFMS) indicate that the use of open water sites 1, 2, 5, and 6 could result in the shallowing of these areas to the -4-foot MLW elevation which is the state limit on

disposal areas. Since this would result in less flushing and changes in salinity distribution within the upper Mississippi Sound, the Mobile District has recently modified the disposal plan to discontinue use of those areas.

The clay sediments which are present in all of the Sound channels of the Pascagoula project have a high affinity for organic contaminants, such as those produced or consumed by the industries located in the Pascagoula and Bayou Casotte industrial areas and those carried downstream from agricultural and industrial areas located north of the project area. As such, the sediments within the channel areas serve as a sink for these contaminants and studies indicate that high levels of a number of contaminants currently exist in these sediments. This process would continue to occur without the Federal project unless discharge of these material were curtailed. Maintenance dredging of the currently authorized project would continue to redistribute these materials to other areas of Mississippi Sound during open water disposal.

The barrier islands of the study area, Horn and Petit Bois, are in a natural erosion/deposition cycle which results in the westward migration of the island in question. Without the project this would continue to occur with Horn Island eroding on the eastern end and elongating westward. Petit Bois on the other hand, due to it's position east of the existing entrance channel, will be shortened with continued maintenance of the channel.

The marshes of the Point aux Chenes - Bangs Lake area will continue to erode due to increased exposure to wave activity. This erosion rate has been calculated to have been approximately 10 acres per year for the past 20 years. This loss of wetland will probably continue without the Federal project unless attempts are made to restore the Grand Batture Island chain. This Island, which was substantially lost during the late 1960's served as a protective barrier for these significant resources.

#### PROBLEMS, NEEDS, AND OPPORTUNITIES

The identification of water and related land resource problems, needs, and opportunities in the study area has evolved over a long period; from prior feasibility studies, current investigations, professional observations, and continuing public coordination. Public concerns and desires have been elicited through a public involvement program in which public officials, interest groups, governmental agencies, and other segments of the public have been encouraged to become actively involved and participate in the study process.

The principal difficulties now confronting navigation in Pascagoula Harbor stem from inadequate widths and depths in the existing deep-draft project for the size vessels now calling at the port, inadequate bend widening which presents problems with maneuvering the larger ships at channel bends,

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and cross-currents in the entrance channel which under certain conditions force vessels to progress on a diagonal with the channel. Greater channel dimensions are needed by the tankers transporting crude oil to Bayou Casotte and by the bulk carriers exporting grain from the elevator on Pascagoula River. The average sizes in both of the above vessel categories have been steadily increasing, which compounds the problem. Many of the vessels calling at the port are lightloading to move through the existing channels. The inability of the harbor to accommodate a distribution of vessels that can provide the most economical movement of the principal port commodities is believed to have retarded local industrial development and depressed the general economy of the area.

Inadequate channel and turning basin dimensions in Pascagoula could lead to hazardous situations where the larger vessels are involved. The large volumes of flammable materials moving through the harbor render such a situation hazardous to both life and property. Other difficulties reportedly arise in navigating the entrance channel from the Gulf of Mexico into Mississippi Sound. Local pilots contend that the open sea conditions and rapid shoaling of the channel at the west end of Petit Bois Island are such that grounding is a hazard in navigating the channel.

Maintenance of the existing navigation project at Pascagoula requires periodic dredging and disposal of dredged materials. Finding adequate disposal areas for dredged materials that are not environmentally damaging has become increasingly difficult and a major problem with or without future harbor improvements. New areas and methods of dredging and disposal should be identified so that the material dredged from project channels can be used to best advantage.

Pascagoula Harbor is filled and surrounded by a wide variety of animal and plant resources that directly and indirectly contribute to human enjoyment and sustenance. In the Pascagoula area marine resources are one of the major concerns. Some of the problems in the area are:

- a. Open water disposal in Mississippi Sound results in reduced circulation and flushing, causing some areas to hold pollutants and producing greater fluctuations in salinity levels throughout the estuary.

- b. Bayou Casotte (industrial discharges) and Bayou Chico (urban runoff) exhibit significant water quality degradation.

- c. Dredging and open water disposal activities, although temporary, increase turbidity, degrade water quality, destroy or damage benthic resources, and disturb fishery resources.

- d. Petit Bois Island and Horn Island are eroding, apparently from westward migration and channel maintenance.

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e. Oyster production has declined in the recent past; partially due to changes in salinity and circulation patterns, but also to overharvesting without replacement of spat and to excess coliform levels.

f. High bacterial counts or toxic pollutants in West Pascagoula Bay have caused producing oyster reefs to be closed.

g. There is a need for additional sport fish habitat in the inshore and offshore waters of the Gulf of Mexico.

h. Wetlands are vital to maintaining proper levels of marine productivity. Wetlands surrounding Pascagoula have diminished because of erosion, deposition, severe storms, natural progression, and man-made events such as dredging, filling, and actions which change water circulation.

The Pascagoula area has rapidly grown in population and economic development over the past decade. With increase in population there comes an increase in socioeconomic problems and needs. The following is a list of some of those problems and needs that are of concern to local interests:

a. Saltwater intrusion is becoming a problem in Pascagoula due to overpumping.

b. Providing harbor improvement is considered necessary to assure continued economic growth throughout the area.

c. The recreational potential of Petit Bois and Horn Island requires enhancement.

d. Abandoned dredge equipment, submerged disposal areas, and mud balls left from disposal cause hazards to recreational fishermen.

e. Boat docks and a temporary refuge anchorage is needed at Horn Island.

f. There is a need for more parking facilities and beach and water access for public use.

g. Many existing water-based recreational areas need improvement.

## STUDY OBJECTIVES, INSTITUTIONAL ANALYSIS, AND CONSTRAINTS

### OBJECTIVES

The Corps of Engineers seeks plans that provide solutions for existing navigation problems and enhance the economic future of the study area. Wherever possible, these plans should incorporate features that enhance the area's environmental quality. Based on a preliminary assessment of the

problems needs and opportunities in the study area, the following study objectives were developed.

a. Recommend the plan that reasonably maximizes net economic development (NED) benefits, unless there are believed to be overriding reasons favoring the selection of another alternative which would justify an exception by the Assistant Secretary of the Army for Civil Works.

b. Develop a plan of improvement that meets the needs of present and future navigation and minimizes the impacts of dredged material disposal. The plan should also contribute to environmental quality and enhance recreational values.

#### INSTITUTIONAL ANALYSIS

A number of Government agencies both affect and are directly affected by Federal dredging and dredged material disposal activities in the study area. Some of these agencies are regulatory in nature and directly affect the conduct of dredging. Others are advisory and play a role in the formulation and development of project plans. Those that are affected by Federal project activities are consulted for input as plans are developed. A list of these agencies and with a brief description of their role or mission as it relates to Federal dredging activities is provided below. It is not an all-inclusive list of agencies with which project plans are coordinated. It is a list which emphasizes key agencies in the institutional framework relative to dredging of Federal projects.

##### Federal Government

Environmental Protection Agency (EPA). The EPA is generally responsible for the enforcement of Federal laws regarding air and water quality, solid waste, and hazardous materials. Relative to Federal dredging activities, the EPA and the Corps have established the guidelines for the evaluation of the water quality impacts associated with the disposal of dredged material as required by Section 404(b)(1) of the Clean Water Act (CWA). Similarly, the EPA and the Corps have developed the evaluative criteria for the specification of ocean dumping sites in accordance with the Marine Protection, Research, and Sanctuaries Act. EPA also maintains a veto authority over decisions made by the Corps regarding specification of disposal sites under Section 404(C) of the CWA. In the Clean Air Act (Section 309), EPA has been given the authority to review and comment on actions subject to the National Environmental Policy Act (NEPA) and to refer those actions to the Council on Environmental Quality (CEQ) if the agency finds the action to be unacceptable from an overall environmental standpoint.

Fish and Wildlife Service (FWS). The FWS is responsible for evaluation of project impacts to Fish and Wildlife resources and making recommendations

concerning the conservation of those resources and mitigation of impacts. Those recommendations must be considered in project planning (Fish and Wildlife Coordination Act). Enforcement and coordination under the Endangered Species Act is the responsibility of the FWS. The FWS is the responsible agency for compliance with the coordination and consultation requirements under the Coastal Barrier Resources Act.

National Marine Fisheries Service (NMFS). The NMFS is responsible for evaluation of project impacts on marine life and providing input into project planning regarding conservation of this resource and mitigation of adverse impacts. Recommendations must be considered in project planning. NMFS also has enforcement and coordination responsibilities under the Endangered Species Act for endangered species in the marine environment.

National Park Service, Office of Archeological Services (OAS). The OAS is charged primarily with overseeing the historic preservation program established as a result of the Archeological and Historic Preservation Act of 1974. A primary function is the review of historic preservation reports prepared by various Federal agencies. In addition, OAS submits an annual report to Congress on the status of historic preservation activities.

National Park Service, Gulf Islands National Seashore (GINS). Ship, Horn, and Petit Bois Islands are part of the Gulf Islands National Seashore system. Federal project activities which would affect these areas must be coordinated with GINS. Federal project activities cannot adversely affect the natural and recreational values on which the GINS designation is based.

Advisory Council on Historic Preservation (ACHP). The ACHP was established under the National Historic Preservation Act to advise the President and Congress on matters related to historic preservation. Federal agencies are required to afford the ACHP an opportunity to comment on any Federally-funded or licensed activities that may have an effect on any District, building, site, structure, or object that is listed in or is eligible for inclusion in the National Register of Historic Places.

#### State of Mississippi

Department of Natural Resources, Bureau of Pollution Control (BPC). The BPC has the responsibility to provide for the prevention, abatement, and control of new or existing air and water pollution in the State. The BPC has the authority to adopt, modify, or repeal rules and regulations necessary to prevent, control, and abate existing or potential pollution. The BPC develops comprehensive programs to deal with pollution, the primary method being a statewide system of permitting air and water pollution sources. With respect to dredge and fill activities, the BPC issues water quality certification for permit actions and Corps projects involving Section 404 of the Clean Water Act.

Department of Natural Resources, Bureau of Parks and Recreation. The Bureau of Parks and Recreation provides outdoor recreation opportunities and is responsible for developing and providing recreational demand, supply, and needs data to the Corps for recreational development.

Department of Wildlife Conservation, Bureau of Marine Resources (BMR). The BMR is tasked with the responsibility of balancing the demand for the use of land and water resources in coastal Mississippi while preserving the natural beauty and environment of the region. BMR administers the State's coastal wetlands law and the Mississippi Coastal Program (established under the Federal Coastal Zone Management Act), with which Federal dredging activities must be consistent. The Governor selected the BMR to develop an allocation process to be used in making Coastal Energy Impact Program grants and loans.

Department of Archives and History (State Historic Preservation Officer). The Department of Archives and History reviews Federal activities under requirements of the National Historic Preservation Act. The agency participates in the process to determine site eligibility for the National Register of Historic Places and in the determination of appropriate mitigation measures for sites on or eligible for the Register that would be affected by a proposed Federal project. The Department performs other functions related to historic preservation in the State.

Office of the Governor, Department of Planning and Policy, Federal-State Programs. The Federal-State Programs office is the State Clearinghouse for review of Federal activities and Federal grant applications. This office would provide the Governor's position on a Federal project in which two or more State agencies have provided conflicting comments.

#### Local Agencies

Local agencies are coordinated primarily in terms of their roles as local sponsors for Federal projects. Sponsors are generally responsible for providing suitable lands, easements, and rights-of-way, and diking necessary for upland disposal of dredged material. If beach nourishment were the preferred method of disposal when a less costly alternative was environmentally acceptable, the local sponsor would generally be required to fund the incremental difference in cost. The local sponsor for this study is the Jackson County Port Authority. Project plans were also coordinated with other city and county agencies and regional planning commission to seek input and comments and to insure compatibility with existing local policy and programs.

## CONSTRAINTS

Legal Constraints. A number of Federal laws constrain and guide the agencies concerned with planning, construction, and maintenance of Federal projects. Those laws, with particularly applicable sections, are identified below.

National Environmental Policy Act, 42 U.S.C. 4341 et seq. (NEPA, Public Law 91-190, as amended): Section 101, Section 102.

Clean Water Act, 33 U.S.C. 1251 et seq. (Federal Water Pollution Control Act, Public Law 92-500, as amended): Section 101, Section 401(a), Section 404(b), Section 404(e), Section 404(f)(1), Section 404(r).

Marine Protection, Research, and Sanctuaries Act, 33 U.S.C. 1401 et seq., Section 2, Section 103(e).

Federal Projects Involving Dredged Material (33 U.S.C. 1413(e)).

Coastal Zone Management Act, 16 U.S.C. 1451 et seq.: Section 307.

Endangered Species Act, 16 U.S.C. 1531 et seq.: Section 2, Section 7.

Clean Water Act, 33 U.S.C. 1251 et seq.: Section 101, Section 401, Section 404.

Fish and Wildlife Coordination Act, 16 U.S.C. 661 et seq.

Marine Protection, Research, and Sanctuaries Act, 33 U.S.C. 1404 et seq.: Section 2, Section 103(e).

Estuary Protection Act, 16 U.S.C. 1221 et seq. (Public Law 90-454).

Coastal Zone Management Act, 16 U.S.C. 1451 et seq.: Section 307.

Clean Air Act, 42 U.S.C. 7401 et seq.: Section 176(c).

Gulf Islands National Seashore System (Public Law 91-660): Section 6, Section 9.

National Historic Preservation Act, 16 U.S.C. 470 et seq.: Section 106.

Archeological and Historic Preservation Act, 16 U.S.C. 469 et seq.: Section 6.

Coastal Barrier Resources Act (Public Law 97-348).

Physical Constraints. Early in the study it was evident that the Greenwood Island disposal area (shown on Plates IV through VIII) was too small to contain any significant volume of new work dredging material. The area is confined on three sides, so that any appreciable enlargement of the area could only be into Mississippi Sound in the vicinity where water quality and circulation problems were already apparent. The use of Greenwood Island for new work disposal was, therefore, not considered.

Preliminary coordination with JCPA revealed two physical limitations on inner harbor channel improvements. At the Pascagoula River facility, the grain elevator on the west bank creates an upper limit. The bulkhead on the river side of that facility was designed and constructed prior to the present 38-foot depth channel construction. Engineering studies for JCPA have shown that the bulkhead would have to be completely rebuilt prior to and extensive modification of the channel. To avoid that expense, JCPA proposes to extend a covered grain loader to the mooring clusters south of the elevator. That loader would then service the larger grain ships. The pilots agreed that this would be feasible. Since grain ships would be arriving empty, or only partially loaded, they could be handled in the existing 38-foot deep upstream channel segment and turning basin by turning them prior to loading. (Later investigations also showed that there was no economic benefit in extending that channel beyond that limit.)

In Bayou Casotte, the JCPA terminal facilities "G" & "H" and "E" & "F" are so constructed that the northern corner of the bulkhead supporting the loading area almost touches the edge of the channel. Here also, any channel modification would require rebuilding the bulkhead. Since it was apparent that there was no need for a larger channel in the upper limits of the bayou, JCPA requested that the improved channel extend no further north than the northern limit of the Chevron property. (Later investigations showed there was no benefit in extending it beyond the upper limit of the new turning basin, slightly downstream from there.)

## PLAN FORMULATION

The present Pascagoula Harbor, Mississippi, study was unique in that other studies that directly affected its outcome were being pursued simultaneously. In the discussion of plan formulation and evaluation that follows, it is important to remember that first, the Mississippi Sound and Adjacent Areas study, and then somewhat later, the Special Management Area study, were in progress and interacting with the harbor study. Both of those studies and their results are discussed below.

### PLANS OF OTHERS

The Jackson County Port Authority has been using the "Master Plan, Greater Port of Pascagoula", as a general guide for development since its preparation in September 1975 (see Figure 6). That plan has features which were proposed and considered in the planning for the present study. Those were:

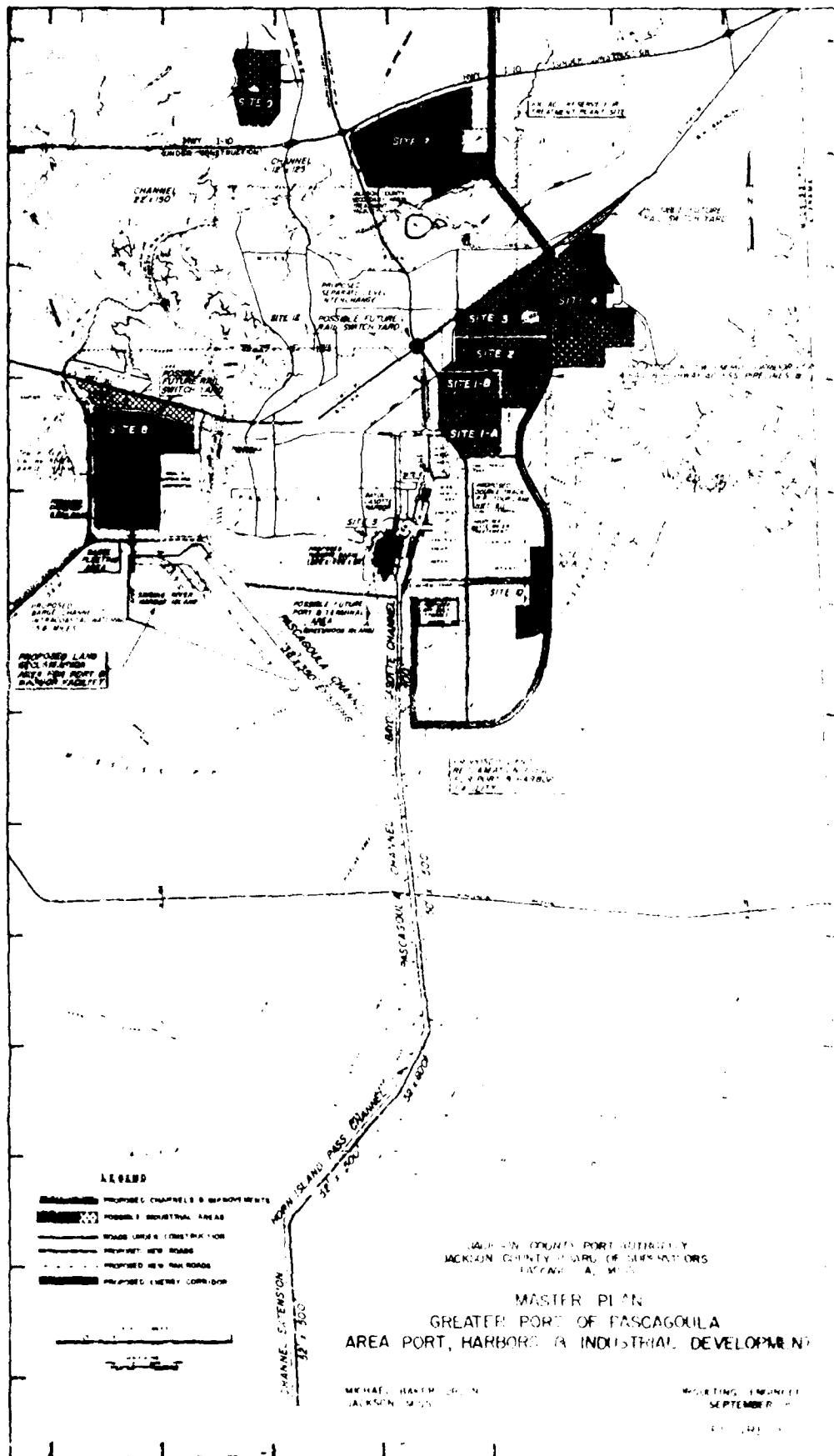
Channels. The Plan proposes a nominally 50-foot by 500-foot channel from deep water in the Gulf of Mexico through Mississippi Sound to a turning basin just inside the mouth of Bayou Casotte. The Channel from the "Y" into the Pascagoula River harbor would remain at its present dimensions of 38 x 350 feet. A 14-foot-deep by 150-foot-wide interharbor barge channel would connect the northern ends of the Pascagoula and Bayou Casotte Channels. Another barge channel 12 feet deep by 150 feet wide would begin in the vicinity of Singing River Island and extend to the southwest to the Gulf Intracoastal Waterway. A barge fleeting area would be developed just north of Singing River Island.

Material Disposal. The plan proposes extensive filling of wetlands and sound bottoms over the long term using dredged material to reclaim land for port and industrial development. Those elements directly involved in the present study were:

a. Point Aux Chenes would be extended to a southern limit about halfway between the mouth of Bayou Casotte and the Gulf Intracoastal Waterway and from the Bayou Casotte channel eastward to a boundary running south of Bangs Lake.

b. Greenwood Island would be filled and extended to the southwest. JCPA presently has plans underway for development of a industrial area called Greenwood Island East, to include a barge fleeting area and terminal development, between the west shore of Bayou Casotte and the disposal area. They plan to use some dredged material from that disposal area in their development, but the volume to be used is presently unknown.

c. Singing River Island would be extended to the southeast and enlarged to over twice its present size and a causeway or bridge would be constructed from the mainland to permit development as an industrial site.





d. The delta area directly west of Ingalls Shipbuilding, from US Highway 90 south to an extension of the Ingalls line and west from the Ingalls west boundary to West Pascagoula River, would be filled to a suitable height and used for industrial development.

All of these areas include existing disposal areas and were apparently planned to extend and build on those areas.

The Pascagoula Special Management Area. The Mississippi Coastal Wetlands Law was passed in 1973 to help prevent development from adversely affecting the coastal environment. The Mississippi Coastal Program (MCP) was implemented in 1980 to supplement regulations with affirmative management efforts. The program designated special management areas (SMA's) and established a process for adopting management plans for these areas. Once an SMA plan has been adopted, it will supersede the general provisions of the MCP. SMA planning for Pascagoula, to include Pascagoula Harbor and the Pascagoula Urban Waterfront, has been in progress for several years. The target date for completing the plan is September 1984.

The MCP identifies three major components of an SMA plan:

a. An Area Development Plan showing the limits of the development and establishing guidelines for planned development within the area.

b. A Dredged Material Plan providing the location of disposal areas and a program to insure adequate disposal capacity to support the area development plan.

c. A Mitigation Program to compensate for environmental losses resulting from development of the area.

The SMA task force was established in late 1981 and began functioning in April 1982. Members included representatives from the following agencies:

US Army Corps of Engineers, Mobile District  
US Environmental Protection Agency  
US Fish and Wildlife Service  
US National Marine Fisheries Service  
Mississippi Bureau of Pollution Control  
Mississippi Bureau of Marine Resources  
Mississippi Department of Archives and History  
Jackson County Port Authority  
City of Pascagoula, Urban Renewal Authority  
City of Pascagoula, Design Consultant

#### STUDY BACKGROUND

The study was originally authorized by the Senate Public Works Committee in September 1965 and was initiated in 1967. Engineering and economic studies

were made and a draft report had been prepared by 1969. The draft report was under review when the Port Authority, in September 1970, requested that the report be deferred pending resolution of difficulties related to the shipment of grain and installation of a bulk handling facility. In May 1971 the Port Authority requested that the study be resumed, advising that their previous difficulties had been resolved. In 1972 the study was resumed but was delayed when it was discovered that the Port Authority was unable to furnish the land necessary to enlarge the existing turning basins. In the interim, a projected development did not materialize. The study was nearing completion in 1975 but it was apparent that the Port Authority was having difficulty in obtaining firm commitments from potential users and in March 1977, they agreed that the study should be postponed until they could reformulate their development planning.

In 1980, at the request of the Port Authority, the study was resumed. Because of changed conditions and passage of various laws since the study was initiated in 1965, the only information which appeared still valid from the previous work were the dredging quantity estimates developed for various channel dimensions. Even those were not fully useful since it appeared that design must now allow for longer and wider vessels, special operating procedures, and other factors which would likely require a different channel cross-section and alignment. Those elements influencing design will be discussed in greater detail in the discussion which follows.

#### MISSISSIPPI SOUND AND ADJACENT AREAS STUDY

During the period the Pascagoula Harbor study was suspended (1977-1980), concerns about the disposal of dredged material from navigation projects throughout Mississippi Sound led to resolutions from the Committee on Environment and Public Works of the United States Senate, adopted 1 February 1977, and the Committee on Public Works and Transportation of the House of Representatives, adopted 10 May 1977. Those resolutions authorized a broad study of the entire area and the projects it contained to determine whether the present and proposed dredged material disposal methods for maintenance and construction should be modified in interest of economic efficiency and environmental quality. The study was to include investigation of various dredging techniques and the possibility of developing a coordinated program for the region, with appropriate consideration of ecological factors.

That study has been recently completed and those results are available in *Report of the Army* (US Army, 1983). However, there was interaction and overlap between the two studies; therefore, those results pertaining to Pascagoula Harbor will be summarized here.

One of the parts of the Mississippi Sound Study was the assessment and evaluation of dredging and material relocation practices, both current and proposed. In an effort to perform this task, a scenario was developed to

PASCAGOULA HARBOR  
CHANNEL

ALTERNATIVE ELEMENTS AND PLANS

Mod. 2  
19600  
11000

I. Horn Island Pass & Guter Bar- Disposal in Area B (New work & O&M)	210
II. Inner Harbors-(New Work & O&M) Pascagoula to Singing River or double barrel Bayou Casotte to Greenwood Island	17
III. Sound Channels-New work to gulf, O&M present practice	70
IV. Sound Channels-New work to gulf, O&M to gulf	70
V. Sound Channels- Bayou Casotte new work to Tennessee Main Channel- lower Sound to Singing River I. - upper Sound to Singing River I. O&M to Greenwood I, Singing River I, or present practice	140 10 140
VI. Sound Channels- Bayou Casotte new work to Grand Batture Main Channel- lower Sound to Singing River I. - upper Sound to Singing River I. O&M to Greenwood I, Singing River I, or present practice	60 10 140

VALUATION OF ALTERNATIVE PLANS	JOB TIME	ANNUAL COSTS	ANNUAL BENEFITS	B/C RATIO
Plan A I+II+III	13.1	3753	24360	6.5
Plan B I+II+IV	13.1	3799	24360	6.4
Plan C I+II+V	25.1	3738	24360	6.5
Plan D I+II+VI	23.7	6098	24360	4.0

## REPRODUCED AT GOVERNMENT EXPENSE

7702/184

	CONTINGENTS	CONSTRUCT	E & O	S & A	CONSTRUCT INTEREST	FIRST COST	I & A	O & M	TOTAL ANNUAL	JOB TIME
	\$1000	\$1000	\$1000	\$1000	\$1000	\$1000	\$1000	\$1000	\$1000	MONTHS
	0	0	0	0	0	0	0	0	0	7
	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	NA	SEE FC	0	0
	1697	8487	255	424	79	9245	767	47	814	4.8
	0	44	1	2	0	47	NA	SEE FC		
	1697	8487	255	424	79	9245	767	47	832	4.8
	12	60	2	3	0	65	NA	SEE FC		
	1694	8470	254	424	123	9271	769	47	816	7.7
	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0
	9	44	1	2	0	47	NA	SEE FC		
	704	28772	853	1459	631	31705	2629	47	2676	10.8
	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0
	9	44	1	2	0	47	NA	SEE FC		

REPRODUCED AT GOVERNMENT EXPENSE

TABLE 11

PASCAGOULA HARBOR ALTERNATIVE EVALUATION  
CHANNEL DEPTH--38 FEET

PRELIMINARY-- PREPARED 07-

DREDGING COSTS									
OTHER PROJECT ASSOCIATED COSTS									
Mob & Demob \$1000	Unit Cost \$/cy	Volume 1000cy	Dredge Cost \$1000	Total Cost \$1000	Dike Cost \$1000	Planting Cost \$1000	Relocate Cost \$1000	Cult Res Cost \$1000	\$
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
727	1.30	4606	5988	6715	0	0	0	0	75
0	0.95	37	35	35	0	0	0	0	0
727	1.30	4606	5988	6715	0	0	0	0	75
0	1.30	37	48	48	0	0	0	0	0
860	1.19	4606	5481	6341	360	0	0	0	75
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0.95	37	35	35	0	0	0	0	0
860	1.96	4606	9028	9888	8030	5025	0	0	75
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0.95	37	35	35	0	0	0	0	0

JAL TTS	B/C RATIO	INITIAL INVESTMENT
5.77	19.1	9245
5.77	18.7	9245
5.77	19.1	9271
5.77	5.8	31705

(2)

TABLE 11

PASCAGOULA HARBOR ALTERNATE  
CHANNEL DEPTH--38

## ALTERNATIVE ELEMENTS AND PLANS

	Mob & Demob \$1000	Unit Cost \$/cy
I. Horn Island Pass & Outer Bar- Disposal in Area D (New work & O&M)	0 0	( (
II. Inner Harbors-(New work & O&M) Pascagoula to Singing River or double barrel Bayou Casotte to Greenwood Island	0 0 0	( ( (
III. Sound Channels-New work to gulf, O&M present practice	727 0	1.30 0.95
IV. Sound Channels-New work to gulf, O&M to gulf	727 0	1.30 1.30
V. Sound Channels- Bayou Casotte new work to Tenneco Main Channel- lower Sound to Singing River I. - upper Sound to Singing River I. O&M to Greenwood I, Singing River I, or present practice	860 0 0 0	1.15 ( ( 0.95
VI. Sound Channels- Bayou Casotte new work to Grand Batture Main Channel- lower Sound to Singing River I. - upper Sound to Singing River I. O&M to Greenwood I, Singing River I, or present practice	860 0 0 0	1.90 ( ( 0.95

EVALUATION OF ALTERNATIVE PLANS	JOB TIME	ANNUAL COSTS	ANNUAL BENEFITS	B/C RATIO	INITIAL INVESTMENT
Plan A I+II+III	4.8	814	15577	19.1	9245
Plan B I+II+IV	4.8	832	15577	18.7	9245
Plan C I+II+V	7.7	816	15577	19.1	9271
Plan D I+II+VI	10.8	2676	15577	5.8	31705

and by the creation of an extensive salt marsh on the lee side of the site. Preliminary calculations revealed that the pumping distance was much too far, and that material quantities much too great, to include channel segments beyond the Bayou Casotte leg. To stabilize the deposited material and prevent future erosion, riprap armor on the south face would be imperative. As evaluation progressed it became obvious that any plan including this element would have a cost greatly exceeding any other combination under consideration.

The plans resulting from the combinations discussed are shown on tables 11, 12, and 13, which follow. The costs of the various elements are estimated and annual costs are computed and compared with annual benefits. The plans are shown on Plates IV through VIII. (NOTE: Since these evaluations were performed it was learned that the Tenneco site would not be available, therefore any alternative involving that site would not be implementable, and the pattern of "present practice" disposal was changed to minimize impacts on Mississippi Sound. Modifications to dredging quantities and costs were also required. However, the tables and plates have been retained since they display the selection process and their relative ranking is still valid.)

#### RATIONALE FOR INTENDED FINAL PLAN SELECTION

Examination of the tables comparing alternative plans clearly indicated economic advantages for Plans A and B, which called for depositing all the dredged material from Mississippi Sound in the Gulf of Mexico. Those plans also avoided most of the environmental problems apparent in the other alternatives. However, an onsite inspection of the Tenneco property at Bayou Casotte in connection with SMA discussions revealed that the site possessed apparent advantages that had not been realized. The property has been used for material disposal previously, probably for the initial construction of the bayou channel. Much of the site is still surrounded by the original dike system which is still in reasonably good condition. The existing dike could be reconditioned and raised with relatively minor expense compared to construction of new dikes elsewhere. In addition the filled area is no longer wetlands and its use would avoid the adverse impacts associated with filling wetlands subject to Section 404 jurisdiction. Moreover, the site is in close proximity to the channel which is why it was originally considered. It appeared then that the site would be ideal for disposal.

Combining the plan elements for gulf disposal for the material from the main channel and deposition on the Tenneco property for the material from the Bayou Casotte Channel, retaining the inner harbor and entrance channel elements which are common to all plans, produces Plan E. That plan, the originally selected plan, possesses the major advantages, and none of the major disadvantages, of the previously considered plans. It had the lowest initial cost and annual cost, the least environmental impact, and the best benefit cost ratio. Those elements for Plan E are compared with the previous plans in Table 14. While there was some doubt about the use of gulf disposal for maintenance dredging, use of that option resulted in a "worst case" analysis. Reverting to present practice for future maintenance would reduce annual costs slightly.

II. Inner Harbors. Tests have shown that recently deposited sediments in both inner harbors, Pascagoula River and Bayou Casotte, are polluted to such an extent that they must be placed in upland disposal areas. These sediments are rapidly dispersed upon entry to the sound, presenting no further problems. (There is a minor reconcentration at the "Y", but not to the extent that it presents a problem.) The new work material to be removed from the turning basin at the mouth of Bayou Casotte contains pollutants only in the upper foot or so. These will be so dispersed in the clean sediments during the dredging process that they will no longer be a factor. The new work dredging in Pascagoula River, which is a relatively minor amount, will be placed in the Double Barrel area. Future maintenance material would be placed in the Double Barrel area or the Singing River Island area, depending upon good management practice at the time. Maintenance material from Bayou Casotte will be placed in Greenwood Island.

The remaining elements all concerned disposal options for the Mississippi Sound Channels. Those were:

III. Sound Channels-New Work to Gulf, O&M Present Practice. As indicated, in this element the new work dredging in Mississippi Sound between the mouths of Pascagoula River and Bayou Casotte and the beginning of Horn Island Pass Channel, would be placed in dump barges and transported to deep water in the Gulf of Mexico. Future maintenance dredging would be placed in open water alongside the channel as is current practice. This disposal method has had no discernable effect on the sound, except in the reach beginning at Singing River Island and extending to the vicinity of the "Y" where there has been measurable shoaling. However, that area could be eliminated from future work without major handicap. Nevertheless, open water disposal is unpopular with some agencies, therefore another element was considered.

IV. Sound Channels-New Work to Gulf, O&M to Gulf. This element is precisely the same as the previous one, except that the material from all future maintenance dredging would be transported to deep water in the gulf.

V. Sound Channels-Bayou Casotte New Work to Tenneco, Main Channel to Singing River Island, O&M Present Practice. An early consideration was to dispose of the Bayou Casotte new work material on the Chevron property south of the present refinery. However, the area available consisted of high quality wetlands and the mitigation cost turned out to be prohibitive. Therefore, the site was transferred to the Tenneco property. Use of Singing River Island for new work deposition would require enlarging it beyond its present limits. The numerical model results indicate that the island could be enlarged to the southwest without further effect on the circulation in the sound.

VI. Sound Channels-Bayou Casotte New Work to Grand Batture, Main Channel to Singing River Island, O&M Present Practice. Rebuilding the eroded Grand Batture Island chain offered substantial benefits from eliminating the erosion of the marsh which had once been protected by that formation

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## DETAILED SCREENING OF ALTERNATIVES

At this stage it was apparent that we were considering deepening and/or widening the existing channels in place, with only minor modification of alignment at such locations where changes were clearly indicated. The problem had clearly become one of evaluating disposal options.

In addition, several evaluation criteria were becoming much clearer. Economic investigations indicated that channel depth would probably optimize at a depth around 42 feet, but at least two additional points would be required for optimization calculations. The existing width of 350 feet does not meet Corps criteria but appears to be adequate for the projected grain fleet, as well as the probable crude oil and LNG carriers. However, substantial benefits could be realized by widening the Bayou Casotte channel from 225 feet to 350 feet. The Greenwood Island disposal site is too small to handle the projected new work volume which would result from widening that channel, and for reasons previously discussed, should not be enlarged beyond its present limits.

A relatively minor feature, which was requested by the Port Authority and endorsed by the bar pilots, was also included in all plans. That was additional widening on the west side of the "Y" to ease the turn into the upper sound leg to Pascagoula River harbor. (Widening of all bends was considered in later stages.)

Two elements had emerged in final form and would be included in any plan that would be considered in detail. Those were:

I. Horn Island Pass and Outer Bar. Formerly treated as two channel segments these were combined into one to facilitate hopper dredging and disposal of the sandy material from that segment in the area designated Area D offshore of Horn Island. In the final stage it was necessary to reestablish both reach identities as different channel widths were developed for each reach. However, both reaches would still be constructed and maintained by hopper dredge. So that hopper dredging would be feasible in the pass, the 40 feet deep, 200 feet wide and 1500 feet long catch basin on the east side of the channel at Petit Bois Island was reconfigured to a 1500-foot long channel reach deepened to 56 feet in approximately the same location. That change should have no effect on the existing flow conditions. During detailed design, consideration should be given to making the catch area deeper on the east side than on the west. In addition, Horn Island Pass channel would be relocated about 500 feet to the west along the same general alignment. This would not increase the initial new work dredging quantity since the natural thalweg is migrating west. This minor realignment would accommodate the natural processes and should reduce dredging in the catch basin for some years after construction. Such minor realignments should be included in the authorization so that they could be performed when indicated in the future. This would eventually eliminate the turn between the pass and outer bar segments at no cost and should reduce the cost of maintenance dredging.

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Early economic surveys showed that deepening and/or widening the project was probably feasible, but that dimensions as great as 55 by 500 feet could not be justified. In addition, rerouting the channel to almost any extent resulted in large quantities of new work dredging, with attendant high costs and extensive environmental damages. As a result, no further consideration was given to rerouting the channel east of Petit Bois Island. That also applied to the straightening of the bar channel from the pass into the gulf, a proposal carried forward from earlier work. While there are some minor benefits from the proposed realignment, they are greatly outweighed by the dredging cost involved.

Use of upland disposal sites eliminates many of the environmental problems associated with dredging and therefore some consideration was given to their use. Numerous sites, shown on Plate II, were investigated for suitability in the early study stages. Pumping and diking costs proved to be excessively high. No material within a reasonable distance was suitable for beach nourishment or creation. Also, since the material throughout the sound is dominantly a clay mud, no commercial use could be developed to offset costs and restore disposal sites.

Environmental surveys revealed that there were extensive grass beds growing in Mississippi Sound directly north of Petit Bois Island in that area being considered for disposal. That disposal location was, therefore, dropped from further consideration.

Creation of artificial islands at three sites which the numerical model indicated would have no effect on overall sound circulations was under consideration when coordination with the office of the Mississippi Coastal Program on other studies indicated that they were very opposed to any deposition plans which would use sound bottoms. It was known that the National Marine Fisheries was also opposed to such plans. Preliminary investigations revealed that material suitable for building dikes in the deeper (10 to 20 feet) open water of the southern sound was not available in the quantity needed for islands large enough for feasible future use. At this point, the consideration of artificial islands was eliminated.

Contact with officials at the Gulf Islands National Seashore (GINS), which owns most of Horn Island and Petit Bois Island, revealed that direct reconstruction of those islands was contrary to GINS policy and could also pose legal problems under Mississippi law. However, they would be pleased if material could be placed in such a fashion that littoral processes could carry it onto the islands naturally. Preliminary estimates indicated that carrying material to the east end of Petit Bois Island was impractical and overly expensive. To be useful the material would have to be placed on a shoal too shallow for hopper dredge dumping and too far from the pass for pumping to be practicable. However, dumping material removed from the Petit Bois catch basin by pipeline dredging on the shoal area east of the tip of Horn Island seemed workable, so that alternative was modified for further study. The various open water sites considered are shown in Plate III.

- e. Dispose of dredged material on the north side of Petit Bois Island,
- f. Use Singing River Island for material disposal, enlarging as necessary, with a view to creating land for industrial development,
- g. Create artificial island in the southern portion of Mississippi Sound using new work material of sufficient size for deposition of future maintenance material.
- h. Use Greenwood Island for material disposal,
- i. Dispose dredged material south of Point Aux Chenes to extend the developable land at Bayou Casotte,
- j. Rebuild the eroded Grande Batture Island chain,
- k. Dispose of dredged material by spreading in a thin layer over a large area in Mississippi Sound,
- l. Continue present disposal practices,
- m. Use upland disposal areas. Possibly material could be removed from these sites for construction to maintain capacity.
- n. Dump dredged material in a deep site in the Gulf of Mexico,
- o. Rebuild the east end of Horn Island, using the sandy material dredged from Horn Island Pass and the bar channel,
- p. Rebuild the east end of Petit Bois Island, using sand from the pass and bar channel,
- q. Various combinations of the above.

#### SCREENING OF ALTERNATIVES

This section discusses both the preliminary and secondary screening of the various alternatives listed and those trade offs considered to arrive at a final array of alternatives for detailed analysis. Very early calculations, using dredging quantities prepared for earlier phases of the study, clearly indicated that there would be serious problems, both economical and environmental, involved in the disposal of the quantities of dredged material resulting from the larger channel dimensions being considered. Some of the above alternatives could, therefore, be dismissed with only cursory examination. Others, which would require only minor modification for continuing consideration, received the indicated changes and were subjected to further analysis.

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Use of Favorable Tides. The bar pilots prefer daylight operation for all large ships therefore the use of this option is limited. The Chevron lighters operate only during daylight hours and the larger grain ships have a similar restriction if the pilots' preference prevails. These vessels must be loaded to provide adequate safety clearance for the anticipated daylight tide conditions. During the economic surveys it was learned that many vessels (usually bulk grain ships) do load to their maximum draft and utilize a favorable tide to provide adequate safety clearance for departure.

Relocate Grain Elevator. Since the bulk grain traffic appears to be the major beneficiary from any improvement of the Pascagoula River channel, consideration was given to the possibility of relocating the grain elevator to Bayou Casotte and eliminating that channel leg from the proposed plan. However, the cost of a new grain elevator would greatly exceed the cost of the proposed channel improvement for that leg. In addition, there are other users, such as the shipyards, which would benefit from an improved channel, even though their use is too infrequent to produce significant benefits for evaluation purposes.

Offshore Unloading Facility. Brief consideration was given to the possible construction of an offshore unloading facility to consist of one or more large buoys to connect with flexible pipelines to pumps and other facilities located on an elevated platform a safe distance away which would pump to onshore storage tanks. However, with knowledge of the recent history of the Louisiana Offshore Oil Port, this did not seem to be a presently viable alternative.

It was concluded that nonstructural alternatives did not adequately address the problems and needs at Pascagoula Harbor, Mississippi.

#### ALTERNATIVE PLANS

A number of plans, or elements of plans, were initially proposed for evaluation. Some of these were derived from the 1975 MASTER PLAN prepared by Michael Baker, Jr., Inc. for the Port Authority. Others were formulated in response to public comment and environmental enhancement concepts. These plans included:

- a. Deepen and/or widen the existing navigation channels, generally along existing alignments, dimensions to be determined, but ranging up to 55 feet by 500 feet,
- b. Deepen, widen, and reroute the bar channel from Horn Island Pass into the gulf,
- c. Dredge a new channel from the "Y" (the junction between the Pascagoula and Bayou Casotte channels) to the gulf east of Petit Bois Island,
- d. Reroute Horn Island Pass to the west to eliminate the present shoaling problem with material moving west from Petit Bois Island,

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require reevaluation. The same assumptions made for the other sites were used in evaluating the storage capacities of this area.

Recommended Engineering Investigations. Implementation of this plan will require additional engineering to confirm and refine the assumptions utilized. A complete foundation investigation is recommended for each disposal site. In addition, consolidation testing for both foundation and sediment samples is recommended to assess the storage capacities more accurately. This would enable refining the recommended dike heights and consolidation characteristics.

Sequencing of Federal/Non-Federal Disposal Activities. Federal dredging occurs, on the average, on 18-month intervals. Non-Federal dredging, however, occurs on a 24- to 36-month interval. To achieve the consolidation/desiccation results required, non-Federal disposal into the sites must occur at about the same time as Federal disposal. Accordingly, close continuing coordination will be required to assure optimal use of the disposal areas.

#### MODIFICATIONS TO PRESENT DISPOSAL PRACTICES

Results from the Mississippi Sound and Adjacent Areas study indicated that circulation in the northern portion of the sound had been impaired by the shallowing resulting from depositing maintenance material in the open water areas adjacent to both the upper channel legs. The Mobile District has recently abandoned the use of disposal areas 1, 2, 5, and 6A (or 6N). Material formerly placed in those areas will be pumped further south and placed in other areas there. The use of those areas has produced no measureable shallowing over long periods of use and therefore no significant effect is expected to result from placing additional material in them now. The adoption of this plan has resulted in the elimination of the measurable environmental effects of the present maintenance practices.

#### NONSTRUCTURAL PLANS

As discussed in the STUDY BACKGROUND section, the results presented in this report are the end product of three sequential study efforts. During the most recent study increment, the "Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies" (P&G) from the US Water Resources Council replaced the prior "Principles, Standards, and Procedures." The P&G requires consideration of nonstructural alternatives for the solution of water resource related problems. Those nonstructural alternatives considered for Pascagoula Harbor are discussed briefly below.

Lightloading. Within limits, lightloading a large ship is more economical than operating a smaller ship fully loaded. However, field surveys for the collection of economic data revealed that the present users already use this practice. Future LNG traffic would also be expected to lightload.

The Singing River Island and Double Barrel disposal areas could be operated and managed as assumed for about 9 years before dike raising would be required. The Greenwood Island disposal area would have a service life of approximately 15 years before dike raising would be required.

Planning Considerations. Additional containment storage capacity can be gained through active site management aimed at dewatering dredged material. If an active dewatering program is implemented, a saving in storage capacity and service life between 30 and 40 percent could be realized. Therefore, the assumption of a well managed dewatering program was made in evaluating the disposal alternatives considered.

Reclamation of fine-grained material for dike upgrading onsite will restore storage capacity. If dikes must be raised for the next lift of material, the use of material from within the area will be beneficial. Tests will be required to determine if such use is practical.

Another factor was the use of areas by non-Federal interests at erratic intervals. The reduction in site capacity caused by disposal of JCPA/private interest dredging would be small compared to the long-term reduction in site capacity caused from interference with an ongoing dredged material dewatering program. Thus, any long-term solution would benefit from separation of Federal and non-Federal disposal requirements. As an alternative to separation, the non-Federal dredging interests could accommodate their dredging needs to the approximate 18-month frequency of Federal activities.

Storage Capacity Evaluation. On Singing River Island the existing diked area, which encompasses about 203 acres, would be expanded to include an additional 130 acres on the east and north sides of the existing areas. This dike alignment was selected to avoid what is considered to be jurisdictional wetlands within the context of Section 404, Clean Water Act. Over the useful life of the disposal area, dikes would ultimately be raised to 40 feet. The existing diked area at the Double Barrel site encompasses about 115 acres. No additional expansion of this area has been considered. Ultimate dike height at this site also would be 40 feet. The dredged material from the Pascagoula River Channel was proportioned to each site so that the service lives of these two sites would be approximately equal. The results indicate that the disposal areas could be operated between 45 and 55 years. The assumptions of surface water management, active dewatering, limiting dike heights of 40 feet, and foundation and sediment consolidation were made in evaluating the storage capacities of these disposal areas.

The existing dikes at Greenwood Island encompass about 101 acres. No additional expansion of this site has been considered. Results of the analysis indicate that the Greenwood Island disposal area could be operated in excess of 50 years before reaching an average surface height near 40 feet, the limiting dike elevation. At that time, dike stability would

area of the channels with resultant concentration of pollutants from river waters in the sediments of the channels. Open water disposal in the upper Sound has resulted in shallowing of the area and in some cases creation of emergent lands. This has tended to increase the funneling effect of the island. The interruption of the littoral system has probably served to increase the natural erosional activities of the eastern end of Horn Island. In addition, the westward migration of Petit Bois Island results in its western end being dredged during maintenance of the entrance channel.

In addition to these conditions, several developmental concepts revolving around dredging and disposal were simulated within the model to determine possible impacts. These included deepening and widening the channels to 52 feet by 600 feet for the pass, 50 feet by 500 feet for the lower Pascagoula channel, and 50 feet by 400 feet for the upper Pascagoula and Bayou Casotte channels; nourishment of the Grande Batture Islands; disposal of sandy dredged materials in shallow water near the east end of Horn Island; enlargement of Singing River Island from approximately 500 acres to 1,790 acres; extension of the area south of Point aux Chenes to create approximately 2,230 acres of dry land; and a combination of the latter three concepts.

#### LONG-TERM DISPOSAL PLAN (EXISTING PROJECT)

Objectives. As a part of its overall involvement in the SMA planning at Pascagoula Harbor, the Mobile District developed the "Management Plan for Long-Term Disposal of Dredged Material". The function and purpose of that report was to state explicitly the objectives and policies of the COE with respect to the Federal maintenance dredging responsibilities. The report also recommended implementation of the strategy developed and an evaluation and control system to monitor its effectiveness. The scope of the report was limited to the Pascagoula River channel and the Bayou Casotte channel to their junction in Mississippi Sound. Disposal areas considered were the Double Barrel, Singing River Island, and Greenwood Island areas.

The term management strategy implies a long-term plan. Previously, planning for dredging and dredged material disposal at Pascagoula Harbor had been short-range in nature. Continuation of this type planning would result in an inefficient use of resources, both economic and environmental. Development of a long-range management strategy will facilitate a more efficient use of these limited resources.

Remaining Capacities. The remaining capacities of the disposal areas were evaluated for the conditions which approximated current operating methods. The evaluation was also based on the premise that the existing containment dikes would not be raised with the exception of the dikes around the Singing River Island disposal area. There, dike raising is required in some areas to bring all dikes to approximately the same level.

investigate conditions associated with the construction and maintenance of the current project and to predict conditions that might be expected to occur if various alternatives were constructed. A series of base conditions were simulated in the Waterways Implicit Flooding Model with Salinity (WIFMS) numerical model to give a picture of the hydrographic conditions existing under current dredging and disposal operations. Next, the model was modified to mimic bathymetric conditions that existed prior to construction of the existing project. These conditions were simulated in the model and compared to the base conditions to determine what, if any, impacts had occurred in the system that could be attributed to the construction of the existing project. Lastly, a number of channel and disposal area concepts were simulated and compared to base conditions to determine what impacts might occur if any of these plans were constructed. The concepts that were modeled were gathered from existing information and contacts with various Federal, State, and local agencies and were not, by any means, inclusive of all feasible alternatives.

The existing project modeled for Pascagoula Harbor provides for (a) an entrance channel 40 feet deep, 200 feet wide, and about 1,500 feet long adjacent to the channel at the west end of Petit Bois Island; (b) a channel 38 feet deep and 350 feet wide in Mississippi Sound and Pascagoula River to the railroad bridge at Pascagoula, including a turning basin 2,000 feet long and 950 feet wide on the west side of the river below the bridge; (c) a channel 38 feet deep and 225 feet wide from the ship channel in the Sound to the mouth of Bayou Casotte, thence 38 feet deep and 300 feet wide for about 1 mile to a turning basin 38 feet deep, 1,000 feet wide, and 1,750 feet long and (d) smaller channels up the Pascagoula River from the railroad bridge to mile 10 on the Escatawpa River. These conditions have modeled as the existing condition, including open water disposal in Mississippi Sound along the channel and in the Gulf of Mexico in an area approximately 2 miles southeast of Horn Island and 2 miles southwest of Petit Bois Island.

To gain insight into the possible changes induced by construction of the project, a preproject condition was simulated in the model. This preproject condition consists of returning the bathymetric configuration of the channels to that which existed prior to the 22-foot channel which was installed in the 1940's. The 1917 U. S. Coast and Geodetic Survey Navigational Chart #1267 was used to establish these conditions. Primary differences include removal of the existing channels, installing a 17-foot channel from the Pascagoula River to the 17-foot contour in Mississippi Sound, and removal of Singing River Island.

The main impacts from construction of the existing channel involve Singing River Island, openwater disposal in the upper Sound and interruption of the littoral drift along the south side of the barrier islands. Singing River Island acts as a deflector in that it funnels freshwaters from the East Pascagoula River to the east and southeast. These waters would normally flow westward and southwest into the Sound. This deflection of waters has probably resulted in the lack of significant circulation patterns in the



TABLE 12

BOR ALTERNATIVE EVALUATION  
REL DEPTH--42 FEET

PRELIMINARY--

PREPARED 07/06/84

Job	DREDGING COSTS				OTHER PROJECT ASSOCIATED COSTS				CONTIN- GENCIES	CON- STRUCT	E &
	Unit Cost \$/cy	Volume 1000cy	Dredge Cost \$1000	Total Cost \$1000	Dike Cost \$1000	Planting Cost \$1000	Relocate Cost \$1000	Cult Res Cost \$1000	\$1000	\$1000	\$10
240	2.34	2058	4816	5056	0	0	0	0	1264	5320	
U	2.34	23	54	49	0	0	0	0	12	61	
17	0.95	451	428	445	40	0	110	0	146	732	
0	0	0	0	0	0	0	0	0	0	0	
0	0.95	13	12	12	0	0	0	0	3	15	
727	1.61	10813	17409	18136	0	0	7392	75	6401	32004	
0	0.95	96	91	91	0	0	0	0	23	114	
727	1.61	10813	17409	18136	0	0	7392	75	6401	32004	
0	1.3	96	125	125	0	0	0	0	31	156	
542	1.19	6943	8262	8804	360	0	2606	75	2961	14806	
120	2.42	1564	3785	3905	85	400	2140	0	1642	8212	
181	1.34	2306	3090	3271	125	600	2604	0	1651	8253	
0	0.95	96	91	91	0	0	0	0	23	114	
542	1.99	6943	13817	14359	8030	7306	2606	75	8094	40460	
120	2.42	1564	3785	3905	85	400	2140	0	1642	8212	
181	1.34	2306	3090	3271	125	600	2604	0	1651	8253	
0	0.95	96	91	91	0	0	0	0	23	114	

INITIAL  
INVESTMENT

42780

42780

42600

71064

PREPARED 07/06/84

COSTS	CONTIN- GENCIES	CON- STRUCT	E & D	S & A	CONSTRUCT INTEREST	FIRST COST	I & A	O & M	TOTAL ANNUAL	JOB TII
ate Cult Res t Cost	\$1000	\$1000	\$1000	\$1000	\$1000	\$1000	\$1000	\$1000	\$1000	MONT
0	0	1264	6320	190	316	0	6825	566	66	632
0	0	12	61	2	3	0	66	NA	SEE FC	
100	0	146	732	22	37	0	790	66	17	82
0	0	0	0	0	0	0	0	0	0	0
0	0	3	15	0	1	0	17	0	0	0
392	75	6401	32004	960	1600	600	35164	2916	123	3039
0	0	23	114	3	6	0	123	NA	SEE FC	1
392	75	6401	32004	960	1600	600	35164	2916	123	3084
0	0	31	156	5	8	0	168	NA	SEE FC	1
100	75	2961	14806	444	740	278	16269	1349	123	1472
140	0	1642	8212	246	411	670	9539	791	0	791
600	0	1651	8253	248	413	263	9176	761	0	761
0	0	23	114	3	6	0	123	NA	SEE FC	
100	75	8094	40469	1214	2023	1026	44733	3709	123	3832
190	0	1642	8212	246	411	670	9539	791	0	791
600	0	1651	8253	248	413	263	9176	761	0	761
0	0	23	114	3	6	0	123	NA	SEE FC	

TABLE 13

PASCAGOULA HARBOR ALTERNATIVE EVAL  
CHANNEL DEPTH--46 FEET

## ALTERNATIVE ELEMENTS AND PLANS

DREDGING

	Mob & Demob \$1000	Unit Cost \$/cy	Value 1000
I. Horn Island Pass & Outer Har- Disposal in Area D (New work & O&M)	240 0	2.34 2.34	41
II. Inner Harbors-(New work & O&M) Pascagoula to Singing River or double barrel Bayou Casotte to Greenwood Island	17 0 0	0.95 0 0.95	
III. Sound Channels-New work to gulf, O&M present practice	727 0	1.95 0.95	15
IV. Sound Channels-New work to gulf, O&M to gulf	727 0	1.95 1.30	15
V. Sound Channel- Bayou Casotte new work to Tenneco Main Channel- Lower Sound to Singing River I. - upper Sound to Singing River I. O&M to Greenwood I, Singing River I, or present practice	542 120 181 0	1.19 2.23 1.40 0.95	9 3 3
VI. Sound Channels- Bayou Casotte new work to Grand Batture Main Channel- Lower Sound to Singing River I. - upper Sound to Singing River I. O&M to Greenwood I, Singing River I, or present practice	542 120 181 0	2.09 2.23 1.40 0.95	9 3 3

EVALUATION OF ALTERNATIVE PLANS	JOH TIME	ANNUAL COSTS	ANNUAL BENEFITS	B/C RATIO	INITIAL INVESTMENT
Plan A I+II+III	21.1	6325	23527	3.7	73799
Plan B I+II+IV	21.1	6367	23527	3.7	73799
Plan C I+II+V	30.6	5803	23527	4.1	67501
Plan D I+II+VI	34.9	8750	23527	2.7	103041

TABLE 13

PASCOGUE HARBOR ALTERNATIVE EVALUATION  
CHANNEL DEPTH--44 FEET

PRELIMINARY--

										CONTIN-
										GENCIES
DREDGING COSTS					OTHER PROJECT ASSOCIATED COSTS					
Mob % Demob \$1000	Unit Cost \$/cy	Volume 1000cy	Dredge Cost \$1000	Total Cost \$1000	Dike Cost \$1000	Planting Cost \$1000	Relocate Cost \$1000	Cult Res Cost \$1000		\$1000
240	2.34	4860	11372	11612	0	0	0	0		2903
0	2.34	23	54	49	0	0	0	0		12
17	0.95	959	911	928	90	0	105	0		281
0	0	0	0	0	0	0	0	0		0
0	0.95	13	12	12	0	0	0	0		3
727	1.95	15982	31165	31892	0	0	8038	75		10001
0	0.95	96	91	91	0	0	0	0		23
727	1.95	15982	31165	31892	0	0	8038	75		10001
0	1.30	96	125	125	0	0	0	0		31
542	1.19	9191	10937	11479	360	0	2834	75		3687
120	2.23	3331	7428	7548	100	800	2370	0		2705
181	1.40	3460	4844	5025	150	1200	2434	0		2302
0	0.95	96	91	91	0	0	0	0		23
practice										
542	2.09	9191	19209	19751	8030	9537	2834	75		19057
120	2.23	3331	7428	7548	100	800	2370	0		2705
181	1.40	3460	4844	5025	150	1200	2434	0		2302
0	0.95	96	91	91	0	0	0	0		23
practice										

ANNUAL BENEFITS	B/C RATIO	INITIAL INVESTMENT
13527	3.7	73799
23527	3.7	73799
23527	4.1	67501
13527	2.7	103041

REPRODUCED AT GOVERNMENT EXPENSE

PRELIMINARY-- PREPARED 07/15/64

	CONTIN- GENDER	CON- STRUCT	C & D	C & A	CONSTRUCT INTEREST	FIRST COST	I & A	C & M	TOTAL ANNUAL	J'S TIME
Stress Cost	\$1000	\$1000	\$1000	\$1000	\$1000	\$1000	\$1000	\$1000	\$1000	MONTHS
0	2903	14516	455	126	0	15677	1330	16	1566	13.0
0	12	61	5	3	0	66	NA	SEE FC		
0	281	1404	42	70	0	1516	126	17	142	5
0	0	0	0	0	0	0	0	0	0	0
0	3	15	0	1	0	17	NA	SEE FC		
75	10001	50006	1500	2500	2600	56607	4694	123	4817	18.1
0	23	114	5	5	0	123	NA	SEE FC		
75	10001	50006	1500	2500	2600	56607	4694	123	4859	18.1
0	31	156	1	8	0	165	NA	SEE FC		
75	5687	14435	553	222	449	20359	1688	123	1811	12.3
0	2705	13523	406	576	2511	17115	1419	0	1419	9.8
0	2502	11511	345	576	401	12833	1064	0	1054	5.5
0	23	114	5	6	0	123	NA	SEE FC		
75	12047	50284	1509	2514	1593	55900	4635	123	4758	16.6
0	2705	13523	406	576	2511	17115	1419	0	1419	9.8
0	2502	11511	345	576	401	12833	1064	0	1064	5.5
0	23	114	5	6	0	123	NA	SEE FC		

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TABLE 14

PASCAGOULA HARBOR ALTERNATIVE EVALUATION  
CHANNEL DEPTH--42 FEET

ALTERNATIVE ELEMENTS AND PLAN	DREDGE		
	Mob & Demob \$1000	Unit Cost \$/cy	Vol 1000
I. Horn Island Pass & Outer Bar- Disposal in Area D (New work & O&M)	240 0	2.34 2.34	2
II. Inner Harbors-(New work & O&M) Pascaoula to Singing River or double barrel Bayou Cassette to Greenwood Island	17 0 0	0.95 0 0.95	
III. Sound Channels-New work to gulf, O&M present practice	727 0	1.61 0.95	10
IV. Sound Channels-New work to gulf, O&M to gulf	727 0	1.61 1.30	10
V. Sound Channels- Bayou Cassette new work to Tenneco Main Channel- lower Sound to Singing River I. - upper Sound to Singing River I. O&M to Greenwood I, Singing River I, or present practice	542 120 181 0	1.19 2.42 1.34 0.95	6 1 2
Va. Sound Channels- Bayou Cassette new work to Tenneco Main Channel-New work to gulf, All O&M to gulf	842 727 0	1.19 1.61 1.30	6 3
VI. Sound Channels- Bayou Cassette new work to Grand Batture Main Channel- lower Sound to Singing River I. - upper Sound to Singing River I. O&M to Greenwood I, Singing River I, or present practice	542 120 181 0	1.99 2.42 1.34 0.95	6 1 2

EVALUATION OF ALTERNATIVE PLANS	JOB TIME	ANNUAL COSTS	ANNUAL BENEFITS	B/C RATIO	INITIAL INVESTMENT
Plan A I+II+III	13.1	3753	24360	6.5	42780
Plan B I+II+IV	13.1	3799	24360	6.4	42780
Plan C I+II+V	25.1	3738	24360	6.5	42600
Plan D I+II+VI	28.7	4098	24360	4.0	71064
Plan E I+II+Va	67 13.7	3612	24360	6.7	40527

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16 PRODUCED AT GOVERNMENT EXPENSE

TABLE 14

PASCAGOULA HARBOR ALTERNATIVE EVALUATION  
CHANNEL DEPTH--42 FEET

PRELIMINARY--

PREPARED 07/05/84

DREDGING COSTS					OTHER PROJECT ASSOCIATED COSTS					CONTIN-	CON-
Mob & Demob	Unit Cost	Volume	Dredge Cost	Total Cost	Dike Cost	Planting Cost	Relocate Cost	Cult Res Cost		GENCIES	STRL
\$1000	\$/cy	1000cy	\$1000	\$1000	\$1000	\$1000	\$1000	\$1000		\$1000	\$100
240	2.34	2058	4816	5056	0	0	0	0		1264	0
0	2.34	23	54	49	0	0	0	0		12	
17	0.95	451	428	445	40	0	100	0		146	
0	0	0	0	0	0	0	0	0		0	
0	0.95	13	12	12	0	0	0	0		3	
727	1.61	10813	17409	18136	0	0	7392	75		5401	3
0	0.95	96	91	91	0	0	0	0		23	
727	1.61	10813	17409	18136	0	0	7392	75		5401	3
0	1.30	96	125	125	0	0	0	0		31	
542	1.19	6943	8262	8804	360	0	2606	75		2961	1
120	2.42	1564	3785	3905	85	400	2180	0		1642	
181	1.34	2306	3090	3271	125	600	2606	0		1651	
0	0.95	96	91	91	0	0	0	0		23	
842	1.19	6943	8262	9104	360	0	2606	75		3036	1
727	1.61	3870	6231	6958	0	0	4743	0		2936	1
0	1.30	96	125	125	0	0	0	0		31	
542	1.99	6943	13817	14359	8030	7306	2606	75		8094	4
120	2.42	1564	3785	3905	85	400	2180	0		1642	
181	1.34	2306	3090	3271	125	600	2606	0		1651	
0	0.95	96	91	91	0	0	0	0		23	

UAL	B/C	INITIAL
PTS	RATIO	INVESTMENT
24360	6.5	42780
24360	6.4	42780
24360	6.5	42600
24360	6.4	41064
4360	6.7	40507

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REPRODUCED AT GOVERNMENT EXPENSE

6/7/95/84

	CONTIN- GROSS	CON- STRUCT	I & A	I & A	CONSTRUCT INTEREST	FIRST COST	I & A	C & M	TOTAL ANNUAL	JED TIME
	\$1000	\$1000	\$1000	\$1000	\$1000	\$1000	\$1000	\$1000	\$1000	MONTHS
0	1264	6320	100	516	0	6825	566	16	632	5.6
1	12	61	0	5	0	66	NA	SEE FC		
2	146	732	22	37	0	780	66	17	82	3
3	0	0	0	0	0	0	0	0	0	0
4	3	10	0	1	0	17	0	0	0	1
5	401	52034	362	1600	600	35164	2916	123	5039	10.1
6	23	114	5	6	0	123	NA	SEE FC		
7	401	52064	350	1600	600	35164	2916	168	5084	10.1
8	31	155	5	8	0	168	NA	SEE FC		
9	2061	14806	244	740	278	16269	1349	123	1472	10.1
10	142	8210	245	411	670	9539	791	0	791	7
11	1651	8253	248	413	263	9176	761	0	761	5
12	23	114	5	6	0	123	NA	SEE FC		
13	2956	15181	446	750	278	16674	1383	168	1551	10.1
14	2956	14680	449	754	385	16237	1346	0	1346	3.6
15	31	155	5	8	0	168	NA	0		
16	4094	40460	1214	2223	1026	44733	3704	123	5832	13.7
17	142	8212	245	411	670	9539	791	0	791	7
18	1651	8253	248	413	263	9176	761	0	761	5
19	23	114	5	6	0	123	NA	SEE FC		

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Table 14 presents a valid comparison for the the section of the final alternative that was to be recommended. (NOTE: Since these evaluations were performed it was learned that the Tenneco site would not be available, therefore any alternative involving that site would not be implementable, and the pattern of "present practice" disposal was changed to minimize impacts on Mississippi Sound. Modifications to dredging quantities and costs wee also required. However, the tables and plates have been retained since they display the selection process and their relative ranking is still valid.)

#### REITERATION OF FINAL PLAN SELECTION

Recent information received from Tenneco concerning their proposed development plans for the Tenneco site revealed that their predicted date of construction for their LNG facility preceded the possible construction date of the improved project. Therefore, the Tenneco site would not be available for use as a disposal site and those plans predicated upon its use, Plans C and E, are not implementable. In addition, Tenneco plans to construct their own turning basin south of the mouth of Bayou Casotte. Since that would eliminate their use of the proposed Federal basin, the design of the basin had to be reconsidered.

In addition, late stage review of this report had indicated that certain modifications of the cost estimates were indicated. During the feasibility study and preparation of the report, the primary concern was for the responsibilities of the Federal government. Consequently, the dredging to be performed by local interests for berthing and access was not included in the quantities shown in Tables 11 through 14. In addition, it had been planned to perform the computations for bend widening during final design, since the amount of dredging was not considered significant. It was determined, however, that a preliminary design was required for the report. Consequently, bend widening tangents were laid out and quantities were estimated and added to the earlier estimates.

Recently the present maintenance disposal plan was modified to eliminate the four northernmost open water disposal areas. That change resulted in a slight increase in the O&M dredging cost to be used. Also, the boundary of the proposed Disposal Area D, south of Horn Island, as shown on the original plates, had confused some reviewers as to the intended limits and use of that area. Therefore, to clarify that point, the boundary was redrawn on the new plate for the selected plan. That change had no other effect.

Notwithstanding the detailed analysis of dredging costs which had gone into the preparation of the report, and since the proposed method of construction was new and untried, it was determined the the costs originally used were too low. New unit costs for the proposed gulf disposal alternatives have been used. In addition, the hopper dredging costs were revised to more properly reflect current experience with that method. Despite the changes discussed, the preceeding sections and Tables 11 through 14, still correctly reflect the relative ranking of the proposed alternatives.

R: 3/85

new comparison of alternatives, using all of the modifications discussed above, is presented in Table 15. It is apparent that the final plan must be a choice between Plans A and B, since Plan D has a much greater cost than either of those two with only an insignificant increase in benefits. Non-quantifiable benefits resulting from Plan D may in fact be quite large, but do not lend themselves to an economic analysis.)

It could be argued that Plan B, which would eliminate future deposition of maintenance material in the open waters of Mississippi Sound, could result in the future improvement of environmental conditions in the sound. However, that benefit is also non-quantifiable since the effects of the recently modified maintenance plan appear to be insignificant. (See MODIFICATIONS TO PRESENT DISPOSAL PRACTICES, page 57). Based on the preceding, Plan A as modified becomes the selected plan. It is implementable, minimizes environmental impacts, and has the greatest net benefits. It is therefore the National Economic Development (NED) plan. This plan, denoted as Modified Plan A, will be presented in further detail as the Selected plan and is shown on Plate IX.

Table 14 presents a valid comparison for the the section of the final alternative that was to be recommended. (NOTE: Since these evaluations were performed it was learned that the Tenneco site would not be available, therefore any alternative involving that site would not be implementable, and the pattern of "present practice" disposal was changed to minimize impacts on Mississippi Sound. Modifications to dredging quantities and costs wee also required. However, the tables and plates have been retained since they display the selection process and their relative ranking is still valid.)

#### REUTERATION OF FINAL PLAN SELECTION

Recent information received from Tenneco concerning their proposed development plans for the Tenneco site revealed that their predicted date of construction for their LNG facility preceded the possible construction date of the improved project. Therefore, the Tenneco site would not be available for use as a disposal site and those plans predicated upon its use, Plans C and E, are not implementable. In addition, Tenneco plans to construct their own turning basin south of the mouth of Bayou Casotte. Since that would eliminate their use of the proposed Federal basin, the design of the basin had to be reconsidered.

In addition, late stage review of this report had indicated that certain modifications of the cost estimates were indicated. During the feasibility study and preparation of the report, the primary concern was for the responsibilities of the Federal government. Consequently, the dredging to be performed by local interests for berthing and access was not included in the quantities shown in Tables 11 through 14. In addition, it had been planned to perform the computations for bend widening during final design, since the amount of dredging was not considered significant. It was determined, however, that a preliminary design was required for the report. Consequently, bend widening tangents were laid out and quantities were estimated and added to the earlier estimates.

Recently the present maintenance disposal plan was modified to eliminate the four northernmost open water disposal areas. That change resulted in a slight increase in the O&M dredging cost to be used. Also, the boundary of the proposed Disposal Area D, south of Horn Island, as shown on the original plates, had confused some reviewers as to the intended limits and use of that area. Therefore, to clarify that point, the boundary was redrawn on the new plate for the selected plan. That change had no other effect.

Notwithstanding the detailed analysis of dredging costs which had gone into the preparation of the report, and since the proposed method of construction was new and untried, it was determined the the costs originally used were too low. New unit costs for the proposed gulf disposal alternatives have been used. In addition, the hopper dredging costs were revised to more properly reflect current experience with that method. Despite the changes discussed, the preceeding sections and Tables 11 through 14, still correctly reflect the relative ranking of the proposed alternatives.

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comparison of alternatives, using all of the modifications discussed, is presented in Table 15. It is apparent that the final plan must be a choice between Plans A and B, since Plan D has a much greater cost than either of those two with only an insignificant increase in benefits. (Quantifiable benefits resulting from Plan D may in fact be quite small, but do not lend themselves to an economic analysis.)

It could be argued that Plan B, which would eliminate future deposition of maintenance material in the open waters of Mississippi Sound, could result in future improvement of environmental conditions in the sound. However, that benefit is also non-quantifiable since the effects of the newly modified maintenance plan appear to be insignificant. (See MODIFICATIONS TO PRESENT DISPOSAL PRACTICES, page 57). Based on the preceding analysis, Plan A as modified becomes the selected plan. It is implementable, minimizes environmental impacts, and has the greatest net benefits. It is therefore the National Economic Development (NED) plan. This plan, denoted as Modified Plan A, will be presented in further detail as the Selected Plan and is shown on Plate IX.

## ALTERNATIVE ELEMENTS AND PLANS

EVALUATION OF ALTERNATIVE PLANS	CONSTRUCTION SUB-TOTAL	CONSTRUCT TIME	IDC	FIRST COST	I&A	O&M	ANNUAL COST	ANNUAL BENEFITS	NET BENEFITS	B/C
Plan A 1+II+III	51420	13.3	2266	53686	4576	304	4882	22342	17480	4.6
Plan B 1+II+IV	51420	13.3	2266	53686	4576	454	5032	22342	17310	4.4
Plan C 1+III+IV	76211	24.5	6503	86511	7378	304	7681	22409	14726	2.9

## DESCRIPTION OF THE PROPOSED PLAN

### DEPTH

Depth. A minimal depth of 44 feet for the entrance channel and 42 feet for the channels north of the entrance limit, up to the end points described below in Alignment, was selected on the basis of economic optimization. Allowances of 2 feet for advanced maintenance and 2 feet for dredging tolerance were made in computing dredging quantities.

Width. The existing width of 350 feet in the Pascagoula River Channel would be retained since information indicates that it is adequate for both present and projected grain traffic. The Bayou Casotte channel would be modified by widening from 225 feet to 350 feet. While Corps criteria indicates a width of 430 feet, local conditions and information developed during this study indicate that a 350-foot width will be adequate for projected future traffic and its use significantly reduces the volume of material to be dredged. Similar reasoning applies to the common leg in Mississippi Sound between the junction of the two channels and Horn Island Pass. The full entrance channel be 200 feet wider than the more protected sound channel for a total channel width of 550 feet. Appropriate bend widening would be provided at all turns. Since at Horn Island Pass the resulting distance between bend widening tangents is short and Horn Island Pass presents the most serious navigation problems all of Horn Island Pass be widened between the bends to provide a total width of 600 feet. A more detailed discussion of the factors involved in the channel design is contained in Appendix B.

Alignment. The improved channel dimensions would be constructed along the existing alignment, with minor exceptions which are discussed in Appendix B. The Bayou Casotte Channel would be widened on both sides of the existing centerline from the junction with the Pascagoula Channel to the mouth of the bayou. The Entrance Channel would begin at deep water, or thereabouts, at the 40-foot depth contour, in the Gulf of Mexico continue through Horn Island Pass, and end at P.L. 1, the bend north of Petit Bois Island, where it would also be the beginning of the sound channels. The improved entrance to the Pascagoula Channel would end about 500 feet downstream of the entrance to the bayou at about mile 0.9. The improved Bayou Casotte channel would include a new turning basin with an 1150-foot turning diameter just inside the mouth of the bayou and would end at the northern limit of that basin at about station 121400 N.

### SEDIMENTATION AND DISPOSAL

Sedimentation. Sedimentation in the Bayou Casotte. Disposing the Pascagoula River bottom will require the removal of an estimated 451,000 cubic yards of sedimentation, which would be placed in the available disposal area. This amount would not significantly affect the long-term disposal capacity of the disposal area. Sedimentation from the Bayou Casotte River would be placed in the same area. Barge disposal on the Horn Island River Island would require new management practices at the time. Future maintenance material from the Horn Island River is also included in the disposal basin, which would be placed in the disposal area.

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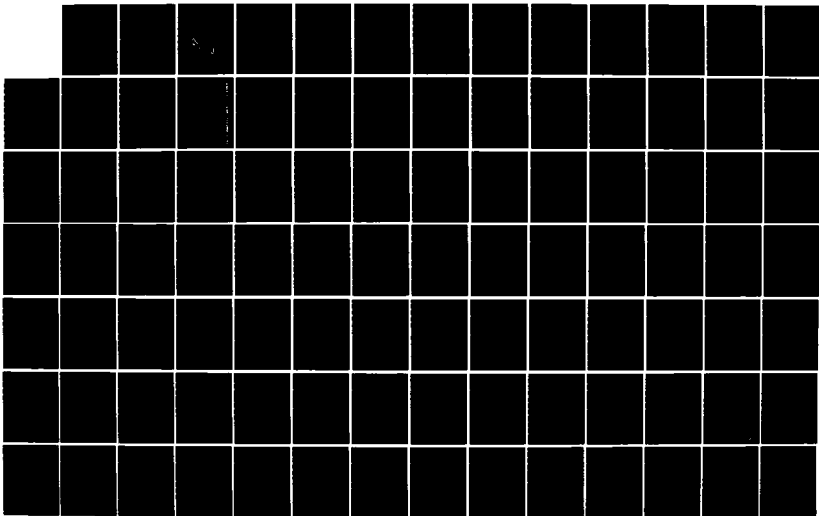
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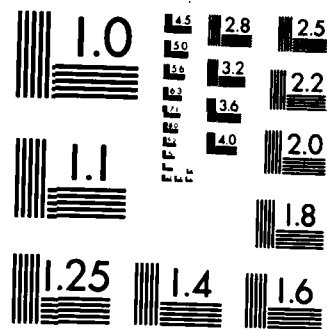
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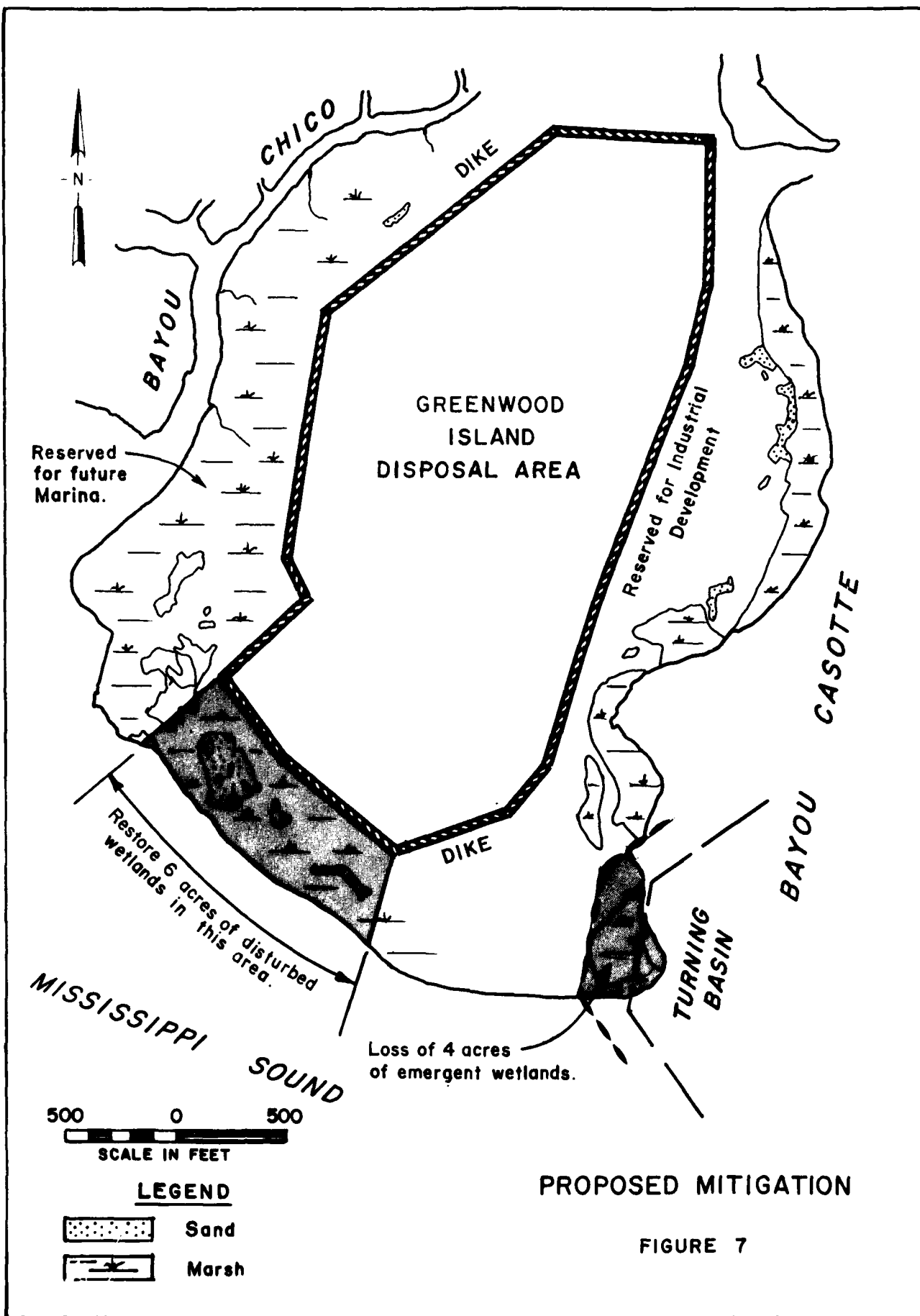


Mississippi Sound Channels. New work material from deepening the present 350-foot wide channel from the mouth of the Pascagoula River to the junction with the Bayou Casotte Channel and then south to the beginning of the Entrance Channel at Horn Island Pass would require dredging 4,866,000 cubic yards of material. The new work dredged material from widening the Bayou Casotte channel from 225 feet to 350 feet would amount to 3,888,000 cubic yards and constructing the new turning basin would require the removal of 2,322,000 cubic yards, for a total estimated to be 6,210,000 cubic yards. The material would be removed by pipeline dredge discharging into bottom-dump hopper barges which would transport the material some 14 miles southwest into the Gulf of Mexico to be dumped between the 50- and 60-foot depth contours. During advanced design, however, consideration will be given to the use of this material for rebuilding Round Island. All future maintenance material from the channels within Mississippi Sound, which would include the Bayou Casotte leg south of the bayou mouth and south of Mile 3 in the Pascagoula Channel, would be disposed of in accordance with existing maintenance practices as recently modified.

Entrance Channel. Hopper dredging the entrance channel would require the removal of 3,348,000 cubic yards of sandy material from Horn Island Pass and the outer bar. Depending upon the size of the dredge performing the work, the material would be dumped between the 15-foot and 30-foot depth contours in an area to the southeast of the east end of Horn Island. That area is presently represented as Area D on Plate VIII. Sandy material placed in that area should help stabilize the offshore profile, slightly reduce wave energy impinging on the south shore of Horn Island, and moderate amounts should generally move to the northwest to nourish the eroding shoreline on Horn Island. In addition, during advanced design consideration will be given to using that material for rebuilding the east end of Petit Bois Island.

#### MITIGATION

Construction of the proposed new turning basin at the mouth of Bayou Casotte, as it is presently sited, would result in the loss of 4 acres of emergent wetlands on the southeast tip of Greenwood Island. To mitigate for that loss, it is presently planned to restore 6 acres of disturbed wetlands on the west side of Greenwood Island (see Figure 7). During advanced design consideration will be given to moving the basin sufficiently to avoid the affected wetlands.



## PLAN IMPLEMENTATION

### ECONOMICS

Costs. Construction of Modified Plan A, the proposed plan described in the previous sections, would require a total investment of \$59,804,000 (\$57,280,000 First Cost plus \$2,524,000 Interest During Construction). A detailed cost estimate is included in Appendix B. Total annual cost, including both interest and amortization (at 8-3/8% interest for 50 years) on that first cost and future maintenance, would be \$5,404,000.

Benefits. Total average annual equivalent benefits (at 8-3/8% interest rate) in the amount of \$22,342,000 would be derived from deepening the Pascagoula Channel, deepening and widening the Bayou Casotte Channel, and providing a new turning basin at Bayou Casotte. Of that amount, \$1,459,000 would result from grain exports, \$14,440,000 would result from crude oil imports to Bayou Casotte, \$1,483,000 would result from petroleum coke exports from Bayou Casotte, \$4,451,000 would result from LNG imports to Bayou Casotte, and \$509,000 would result from combined use of the new turning basin. Derivation of benefits is discussed in detail in Appendix C.

Justification. Benefits for the proposed plan would greatly exceed costs. Net benefits would be \$16,938,000 annually and the benefit/cost ratio would be 4.1 to 1. Environmental damage or loss would be quite small. Constructing a new turning basin in Bayou Casotte would result in the unavoidable loss of 4 acres of emergent wetland for which mitigation by rehabilitating 6 acres of degraded wetland is believed to be justified. (See EIS Par. 6.6) Deepening the Main Channel (Pascagoula Channel) would result in the temporary and short termed disturbance of already existing deep bottoms. Widening the Bayou Casotte Channel would permanently convert 55 acres of shallow bottoms to deep bottoms. Constructing the Bayou Casotte turning basin would result in the conversion of an additional 25 acres of shallow bottoms to deep bottoms. The plan avoids the impacts resulting from disposing new work material in open water or wetlands. Provision for depositing all future maintenance material in upland areas, offshore of Horn Island, or in approved areas in Mississippi Sound avoids future environmental damages. Depositing sandy material offshore of Horn Island will alleviate erosion and enhance that island. The proposed Bayou Casotte turning basin area encompasses two archeological sites that are being damaged by amateurs. Provision for excavating those sites and preserving the remaining relicts has been included in the plan. The Corps of Engineers therefore considers that mitigation beyond that already included in the proposed plan is unwarranted.

### ECONOMIC TESTS OF SELECTED PLAN

Since late stage modifications had resulted in a new selected plan, with a cost greater than the plan originally proposed, there was some question as to whether all the elements of the new plan were still economically justified. This section presents the various analyses and their results.

Incremental Analysis. The incremental feasibility of the Pascagoula River Channel versus the Bayou Casotte Channel can be analyzed by two methods. Both approaches are presented below.

a. Allocated Cost. The details of this method are discussed in Appendix C and the final figures are shown in Table 7, page C-R15, and are summarized here.

<u>Channel</u>	<u>Adjusted Annual Costs (\$1000)</u>	<u>Annual Benefits (\$1000)</u>	<u>B/C Ratio</u>	<u>Remaining Benefits (\$1000)</u>
Bayou Casotte	\$4,051	\$20,883	5.2	\$16,832
Pascagoula River	\$1,353	1,459	1.1	106

b. Last Added. Since the benefits which would accrue to the crude oil and LNG traffic are quite high, it could be assumed that the channel would be improved from the Gulf of Mexico to Bayou Casotte for that traffic, and the Pascagoula River leg from the channel junction to the end point in Pascagoula River would have to be justified by benefits to the grain traffic. On that basis, the pertinent numbers would be as follows:

<u>Channel</u>	<u>Annual Costs (\$1000)</u>	<u>Annual Benefits (\$1000)</u>	<u>B/C Ratio</u>	<u>Remaining Benefits (\$1000)</u>
Bayou Casotte	\$4,063	\$20,883	5.2	\$16,820
Pascagoula River	\$1,341	1,459	1.1	118

NOTE: Both of the above tables exclude traffic delay benefits and are therefore conservative. See Table 7, page C-R16, and Table 59, page C-98, for further explanation.

c. Turning Basin. While there are compelling reasons to include the proposed turning basin at the mouth of Bayou Casotte as a necessary portion of the proposed improvement, it was also indicated that it should be incrementally justified for inclusion. The calculations are shown in Appendix C. Adding the basin will result in an additional increment of annual benefits amounting to \$509,000 at an average annual cost of \$472,000, producing a B/C ratio of 1.08 and remaining benefits of \$37,000.

Sensitivity Analysis for Grain Traffic. All of the traffic on which benefits were based was projected to be constant throughout the project life. It is shown in Appendix C that the Louis Dreyfus Corporation (LDC) controls 28% of the total grain exports from Pascagoula. Of that amount only 3.5% is involved in tonnages that realize savings. For the grain traffic, therefore, it was conservatively taken that the 3.5% would increase to 14%, yielding the \$1,459,000 in annual benefits used above. Since LDC officials have stated that they would take full advantage of a deeper channel, it would not be unreasonable to expect that they would increase use of the larger ships for their controlled traffic to 21% of the total. In that event, the benefits would increase to \$1,629,000 annually.

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Effects if Tenneco Does Not Build LNG Terminal. Tenneco has indicated that their present schedule calls for construction to begin on the LNG terminal in 198x. Due to the present uncertain situation in the world energy market, that planned date is subject to revision. As an extreme case, it is possible that the plant would not be built at all. In that event, the benefits for the Bayou Casotte channel would be reduced to \$16,432,000 annually. For the Incremental Analysis case shown above, the B/C ratio would drop to 4.1 and the remaining benefits would decrease to \$12,381,000. For the Last Added case, the B/C ratio would drop to 4.0 and the remaining benefits would be \$12,369,000. Since the so-called Tenneco site is a part of the planned industrial development area, it is unlikely that it will not be developed in some fashion. However, were Tenneco to abdicate, it is unlikely that some other industry would dredge a separate turning basin and thus there would be no environmental impacts from that particular feature.

Cost Recovery Analysis. EC 1105-2-124 requires that studies for deep-draft navigation include an analysis for the impact of potential cost recovery requirements. This paragraph summarizes the results of a more detailed analysis which is contained in Appendix C, Tables 10 and 11. The EC requires that user fees based on both 50% and 100% cost recovery be determined. It was determined that the project was economically viable with 100% cost recovery and therefore the 50% analysis was not performed. Using the allocated costs previously determined, it was computed that a fee of \$0.84 per ton for users of the Bayou Casotte leg, and \$1.78 per ton for the Pascagoula River leg, would be required to recover 100% of costs in the 50-year economic life under the assumptions given in the EC (see Table 10). At the computed user charge of \$1.78 per ton, that grain originating at Pascagoula for shipment to the Far East would realize a negative benefit of \$0.42 per ton the first year of the project operation (see Table 11). It was computed that the breakeven year for grain movements to the Far East would be 2004. Nevertheless, this is grain controlled by the Louis Dreyfus Corporation, lessee and operator of the grain elevator and the single greatest user of that facility. It does not seem likely, therefore, that the Far East grain movement would be driven to another port. Charges and savings based on the 50-year economic project life are also in Table 9. As has been implied above, no effect on project size, scope, and implementation timing is anticipated from full cost recovery user charges.

Multiport Analysis. The crude oil traffic into Bayou Casotte is input for the Chevron USA refinery there. According to Chevron officials, this refinery, having recently undergone a multibillion dollar modification, is now their most efficient refinery in the eastern half of the US. This traffic, therefore, would not go elsewhere. When Tenneco constructs their LNG terminal on Bayou Casotte, a similar situation will prevail. The petroleum coke presently being exported from Bayou Casotte is a byproduct of the Chevron refinery. The exporter presently lightloads because of the channel limitations and tops off at another gulf port where greater depths are available. His agent has stated that, given adequate depths at Pascagoula, they would fully load there.

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Grain exports from Pascagoula were compared with the seven competing gulf ports, those which are exporting a million tons or more of grain. Six of those ports have a controlling channel depth of 40 feet, while Corpus Christi, Texas has a controlling depth of 45 feet. Based on grain export history, it is not believed that deepening the Pascagoula channel will have an effect on grain movements from the other gulf ports. The greater depth available at Corpus Christi has not increased exports from there. During the 1978-1981 period, grain exports from Corpus Christi dropped from 4.6 million tons to 1.9 million tons, while during the same period, grain exports from Houston increased from 12.8 million tons to 13.5 million tons, and those from Galveston increased from 2.8 million tons to 5.9 million tons. It is apparent that some factor other than available channel depth is at work.

#### COST ALLOCATION

All plans considered were single purpose navigation. Therefore, all costs are allocated to navigation.

#### COST APPORTIONMENT

General legislation authorizing implementation of water resource projects, the most recent being the Water Resources Development Act of 1976, contains local cooperation requirements established by those various laws. This report contains information and results based upon those traditional requirements. The Administration is reviewing project cost sharing and financing across the entire spectrum of water resource development and has proposed a revised policy. The basic principle governing the development of specific cost-sharing policies is that whenever possible the cost of services produced by water projects should be paid for by their direct beneficiaries. It is also recognized that the Federal Government can no longer bear the major portion of the financing of water projects.

New sources of project financing, both public and private will have to be found. While specific policies applicable to the Pascagoula Harbor project have not yet been established, non-Federal interests can expect that, under the Administrations financing and cost-sharing principles, the level of their financial participation will need to be significantly greater than in the past.

It has been traditional Corps policy for general navigation projects to recommend that 100% of the first cost be borne by the Federal Government. Operation and maintenance of the project would also be the complete responsibility of the Federal Government. Acquisition of necessary lands, easements and rights-of-way, including suitable areas for the disposal of dredged material and any necessary dikes, weirs, or bulkheads, is the responsibility of non-Federal interests. The first cost of mitigation is shared between Federal and non-Federal interests based on the ratio between basic project costs, which are defined to include all first costs (excluding mitigation) plus the capitalized costs of operation and maintenance, as they are apportioned between the interests. However, local interests are responsible for maintenance of those mitigation features.

## RESPONSIBILITIES

Federal. The Federal Government would design and prepare detailed plans, construct the project, and share in the cost as discussed above. Pursuant to Corps of Engineers permitting authority, the Federal Government would direct the owners of the pipelines and the cable which cross the navigation project to remove or relocate them prior to construction of the proposed improvements. Construction would be contingent upon Congressional authorization and funding and upon receipt of the non-Federal cost items and the necessary local assurances.

Non-Federal. Formal assurances of local cooperation must be furnished by the local sponsor prior to initiation of construction. The Jackson County Port Authority acts as agent for the Jackson County Board of Supervisors, which is fully capable of satisfying all local cooperation requirements. The local sponsor must agree to:

a. Provide without cost to the United States all lands, easements, and rights-of-way necessary for construction and maintenance of the project, exclusive of lands for fish and wildlife mitigation, and for aids to navigation upon the request of the Chief of Engineers, including suitable areas determined by the Chief of Engineers to be required in the general public interest for initial and subsequent disposal of dredged material, and including necessary retaining dikes, weirs, bulkheads, and embankments therefor, or the costs of such retaining works;

b. Hold and save the United States free from damages due to the construction and maintenance of the project, not including damages due to fault or negligence of the United States or its contractors;

c. Accomplish without cost to the United States all alterations and relocations of buildings, transportation facilities, storm drains, utilities, pipelines, powerlines, sewers, cables, and other structures and improvements necessary for project purposes.

d. Provide and maintain without cost to the United States adequate depth in berthing areas and local access channels;

e. Prohibit erection of any structure within 150 feet of the bottom edge of the project channel and turning basin as authorized;

f. Provide and maintain without cost to the United States adequate public terminal and transfer facilities open to all on equal terms;

g. Fulfill the requirements of non-Federal cooperation as specified in the terms of conditions of the Uniform Relocation Assistance and Real Property Acquisition Policy Act of 1970 (PL 91-6460) approved 2 January 1971; and

h. Provide all lands needed for fish and wildlife mitigation, sharing in their cost and in the cost of the fish and wildlife measures in the same

proportion as the non-Federal share of the total project cost of the basic navigation project, and operate and maintain such measures without cost to the United States.

#### SUMMARY OF COORDINATION, PUBLIC VIEWS AND COMMENTS

On 14 August 1984 a final public meeting was held to present the results of this study. Notices of the public meeting were furnished the United States Senators and Representatives from the area, Federal and state agencies, city and county governments and agencies, and interested organizations and individuals. General support for the selected plan has been received from the US Congressmen and members of their staffs have expressed their continuing interest in the improvement of Pascagoula Harbor.

The majority of those represented at the meeting were in favor of the selected plan for Pascagoula Harbor. There were no objections to the proposed improvement of the deep-draft project and the selected channel dimensions, with one exception, were met with approval. The Pascagoula Bar Pilots Association requested that consideration be given to widening the Entrance Channel to 600 feet. Those objections that were received pertained to plans for disposition of the dredged material. A representative of the US Fish and Wildlife Service objected to the disposal options selected and recommended that dredged material be placed in the gulf. A member of the staff at the Gulf Coast Research Laboratory requested that wetlands be avoided, that shallow water disposal be discontinued, and that consideration be given to nourishing Round Island with material from the sound channels. A representative from National Marine Fisheries Service Pascagoula Laboratory also spoke in favor of nourishing Round Island.

Review comments on the draft feasibility report are addressed in the Environmental Impact Statement contained in this report. Letters from various agencies and organizations are reproduced there, and responses are given to all the comments. The U.S. Fish and Wildlife Coordination Act Report and other appropriate letters have been included in Appendix D, "Environmental Documentation". Coordination letters which did not require responses are included in Appendix E, "Public Involvement and Comments". In general, the resource agencies opposed the use of the Tenneco site for material disposal, an option which has been eliminated, and supported rebuilding the Grand Batture Island chain, the most expensive disposal alternative. A meeting summary was prepared and is available from the Mobile District Office. A tape of the meeting is on file and can be made available.

Fish and Wildlife Coordination Act Report. The U.S. Fish and Wildlife Service, in accordance with the Fish and Wildlife Coordination Act (FWCA), as amended, submitted a report on the final array of alternatives. Their entire report is included in Appendix D. Briefly, the USFWS recommendations presented in that report were:

1. Permanent filling of wetlands and waterbottoms for dredged material disposal should be eliminated from project plans. Channel dimensions should be held to an absolute minimum to reduce dredging requirements.



2. All dredged material should be placed in upland or selected gulf sites unless the intended use was for benefiting fish and wildlife resources. The current maintenance dredging practice of open water disposal in the sound should be discontinued.
3. The FWS recommends that Plan B, with appropriate mitigation, be the selected plan.
4. If the Grande Batture nourishment feature is pursued, they recommend that their proposed modification of that plan be an alternative carried forward for additional study.
5. Plan A also results in minor quantifiable impacts, but is not as desirable as Plan B or the FWS plan. This plan is more preferable than either Plan C or Plan D as proposed and deserves further study.
6. Plan C would result in extensive fish and wildlife losses. The FWS strongly recommends that Plan C as proposed be eliminated.
7. Plan E requires the filling of 257 acres of wetland at the Tenneco site and dredging of 10 acres at Bayou Casotte. The FWS opposes this alternative.
8. If wetland creation from shaving down low productive uplands is implemented as mitigation, it should be developed prior to or concurrently with project initiation.

In summary, USFWS, along with the other resource agencies, would prefer a plan other than the one selected, but they are not opposed to the selected plan. As a result of our Mississippi Sound study and coordination with the various agencies, we have modified our present maintenance disposal practice to eliminate discernable environmental impacts.

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## RECOMMENDATIONS

I have carefully considered the technical information developed for this report, the views of the general public, and the comments of the various agencies, with special attention to those from the resource agencies. Having given due consideration to the various economic and environmental issues, I have concluded that the final plan derived, Modified Plan A, is in the best public interest and that the studies to date are sufficient for the authorization for construction of that plan.

I therefore recommend that the existing Federal navigation project for Pascagoula Harbor, Mississippi, be improved, with such modifications thereof as in the discretion of the Commander, USACE, may be advisable, to provide for:

Deepening and widening the gulf entrance channel to 44 feet by 550 feet from the 44-foot depth contour in the Gulf of Mexico to the bend at the southern end of Horn Island Pass, deepening and widening Horn Island Pass to 44 feet by 600 feet between the bends at the southern and northern ends of that pass, for a distance of about 4-1/2 miles; relocating the Horn Island Pass reach about 500 feet westwardly; reconfiguring the impoundment basin in Horn Island Pass to provide a section within the channel limits 1500 feet long with a total depth of 56 feet to facilitate maintenance by hopper dredge, and allowing for future realignment of the Horn Island Pass reach as natural conditions warrant;

Deepening the main ship channel to 42 feet from the bend at the northern end of Horn Island Pass, through Mississippi Sound and into the Pascagoula River, and terminating about 500 feet south of the grain elevator for a total distance of about 10 miles; widening the bend at the junction with the Bayou Casotte channel from the present 150 feet to 250 feet to provide a total width at the bend of 600 feet and widening the bend at the mouth of Pascagoula River by 280 feet to provide a total width at the bend of 630 feet;

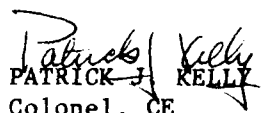
Widening and deepening the Bayou Casotte channel to 42 feet by 350 feet from the junction with the main channel to the mouth of Bayou Casotte, a distance of about 3-1/2 miles; with additional widening at the mouth to provide a turning basin with a total turning diameter of 1150 feet, including the channel width; relieving the northern portion of the area between the junction with the main ship channel from the present 500 feet to 1000 feet, and widening the bend at the mouth of Bayou Casotte from the present 50 feet to 100 feet to provide a total width at the bend of 450 feet.

Mitigation for the unavoidable loss of 4 acres of emergent wetlands by restoring 6 acres of disturbed wetland habitat to a more natural emergent nature.

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The first cost of the recommended plan is estimated to be \$57,280,000, of which the Federal cost would be \$45,530,000 under traditional cost-sharing policies. The exact amount of Federal and Non-Federal cost would be determined by the Chief of Engineers subject to cost-sharing and financing arrangements satisfactory to the President and the Congress.

This recommendation is made with the provision that, prior to the commencement of construction, local interests will, in addition to the general requirements of law for these types of projects, agree to comply with those items set forth in the section on RESPONSIBILITIES in this report.

  
PATRICK J. KELLY  
Colonel, CE  
District Engineer

The recommendations contained herein reflect the information available at this time and current Departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to the Congress as proposals for authorization and/or implementation funding.

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stages of the formulation process. Plans which were retained were subjected to more detailed analysis and of these, five were carried forward as the final array of detailed plans. The plans discussed below were eliminated from further study in the intermediate stage formulation.

3.1.1. Channel Depths. A number of authorized channel depths ranging from 40 feet to 55 feet were considered for channel improvement. Economic analyses were performed for each depth alternatives and it was determined that maximum benefits were obtained with a 42-foot channel. For this reason all other depths have been eliminated from further investigation.

3.1.2 Channel Widths. As with channel depth, a number of channel widths were considered in early planning efforts. Studies indicate, that with the exception of the Entrance Channel and the Bayou Casotte channel, widening was not warranted. Widening of the Bayou Casotte channel to 350 feet, making it compatible with other channel widths in the Upper and Lower Pascagoula channels, widening of the Pass leg of the Entrance Channel to 600 feet, and widening of the Gulf leg of the Entrance channel to 550 feet were carried forward for detailed planning.

### 3.1.3 Alternative Disposal Concepts.

3.1.3a Upland Disposal Sites. A number of upland sites were tentatively identified for upland disposal in the early stages of plan formulation. These sites as shown on Plate II of the Main Report were determined to be unsuitable for any of a number of reasons including: current land use, adjacent land use, habitat, size, or distance from the dredging site.

3.1.3b Enlargement of Singing River Island. The enlargement of the existing dredged material disposal site at Singing River Island from approximately 480 acres to 1,790 acres (Plate III, Main Report) was eliminated from further study due to the significant environmental impacts which would result from filling wetlands and submerged bottoms. In addition, numerical model runs of this alternative indicated localized changes in circulation patterns which could result in significant water quality impacts. The location of this large disposal area in the northwest region of the project would also require significantly increased pumping distances for materials dredged from the lower Pascagoula and Bayou Casotte legs of the project which would be costly.

3.1.3c Extension of the Point aux Chenes Shoreline. This plan would result in the creation of approximately 2,230 acres of dry land using dredged materials in the region south of the Point aux Chenes shoreline (Plate III, Main Report). As with the enlargement of Singing River Island, the environmental impacts of this alternative would be significant and pumping distances would also be greatly increased due to the location. For these reasons, this disposal alternative was not considered further.

3.1.3d Island Creation in Mississippi Sound. Three potential areas were identified in Mississippi Sound that would be suitable for the creation of

5 modifications to the existing navigation project at Pascagoula Harbor are warranted.

2.2 Public Concerns. Jackson County, with its heavy industrial base, depends to a large extent on the continual development of its harbor and related channel facilities. Public concerns considered in the proposed study therefore primarily center around the need for improved waterborne transportation facilities at the Port of Pascagoula. The Main Report examines, in detail, the problems, needs, and opportunities of the study area at Pascagoula, Mississippi.

2.3 Planning Objectives. The planning objectives listed below form a basis from which alternative plans were formulated.

Improve the economic efficiency of moving commodities into and out of Pascagoula Harbor.

Increase navigational safety in Pascagoula Harbor and reduce chance of hazard to life and property.

Provide an adequate and acceptable dredged material disposal plan for project modifications and continued maintenance of Pascagoula Harbor channels.

Reduce or prevent additional saltwater intrusion into the groundwater aquifers.

Provide additional water based recreational opportunities in the study area.

Coordinate dredging and disposal alternatives so that no conflicts arise with existing management plans for Gulf Islands National Seashore properties on Petit Bois and Horn Islands and the State of Mississippi's Coastal Management Plan.

Avoid irreversible commitments of resources to future uses.

Manage, protect, preserve, or enhance valuable resources such as:  
oyster reefs  
wetland and submerged habitats  
commercial and sport fish habitats.

## 2.0 Alternatives

2.1 Plans Eliminated from Further Study. A large array of channel depths and widths and disposal sites were initially considered for implementation for the Pascagoula-Bayou Casotte navigation complex, including those suggested by the public, State and local agencies as well as those conceived by the Corps. These plans are discussed in detail in the Main Report. A large number of these plans were eliminated from further study during earlier

Land Use Plans

No known land use plans will be affected by any of the alternatives.

Required Federal Entitlements

None

\* Plans C and E were determined, during the draft review, to be non-implementable.

NOTES: The compliance categories used in this table were assigned based on the following definitions:

- FC. Full compliance--All requirements of the statute, E.O., or other policy and related regulations have been met for this stage of planning.
- PC. Partial compliance--Some requirements of the statute, E.O., or other policy and related regulations remain to be met for this stage of planning.
- NC. Noncompliance--None of the requirements of the statute, E.O., or other policy and related regulations have been met for this stage of planning.
- NA. Not applicable--N/A statute, E.O., or other policy not applicable.

Table EIS-1  
Relationship of Plans to Environmental Requirements, Protection Statutes,  
and Other Environmental Requirements

Federal Statutes	No Action	Plan A	Plan B	Plan C*	Plan D	Plan E*	Modified Plan A
Archeological and Historic Preservation Act, as amended, 16 USC 469, et seq.	NA	FC	FC	FC	FC	FC	FC
Clean Air Act, as amended, 42 USC 1857h-7, et seq.	NA	FC	FC	FC	FC	FC	FC
Clean Water Act, as amended, (Federal Water Pollution Control Act) 33 USC 1251, et seq.	NA	FC	FC	FC	FC	FC	FC
Coastal Zone Management Act, as amended, 17 USC 1451, et seq.	NA	FC	FC	FC	FC	FC	FC
Endangered Species Act, as amended, 16 USC 1531, et seq.	NA	FC	FC	FC	FC	FC	FC
Estuary Protection Act, 16 USC 1221, et seq.	NA	FC	FC	FC	FC	FC	FC
Federal Water Project Recreation Act, as amended, 16 USC 460-1(12), et seq.	NA	FC	FC	FC	FC	FC	FC
Fish and Wildlife Coordination Act, as amended, 16 USC 661, et seq.	NA	FC	FC	FC	FC	FC	FC
Land and Water Conservation Fund Act, as amended, 16 USC 4601-4601-11, et seq.	NA	FC	FC	FC	FC	FC	FC
Marine Protection, Research and Sanctuaries Act, 33 USC 1401, et seq.	NA	FC	FC	FC	FC	FC	FC
National Historic Preservation Act, as amended, 16 USC 470a, et seq.	NA	FC	FC	FC	FC	FC	FC
National Environment Policy Act, as amended, 42 USC 4321, et seq. 1/	NA	PC	PC	PC	PC	PC	PC
Rivers and Harbors Act, 33 USC 401, et seq.	NA	FC	FC	FC	FC	FC	FC
Watershed Protection and Flood Prevention Act, 16 USC 1001, et seq.	NA	NA	NA	NA	NA	NA	NA
Wild and Scenic Rivers Act, as amended, 16 USC 1271, et seq.	NA	NA	NA	NA	NA	NA	NA
Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (PL 91-646)	NA	NA	NA	NA	NA	NA	NA
The Gulf Islands National Seashore (GIN) System (PL 91-660)	NA	FC	FC	FC	FC	FC	FC
Coastal Barrier Resources Act (PL 97-348)	NA	FC	FC	FC	FC	FC	FC
Executive Orders, Memoranda, etc.							
Flood Plain Management (E.O. 11988)	NA	FC	FC	FC	FC	FC	FC
Protection of Wetlands (E.O. 11990)	NA	FC	FC	FC	FC	FC	FC
Environmental Effects Abroad of Major Federal Actions (E.O. 12114)	NA	NA	NA	NA	NA	NA	NA
Analysis of Impacts on Prime and Unique Farmlands (CEQ Memorandum, 11 Aug 80)	NA	NA	NA	NA	NA	NA	NA
State and Local Policies							
State Water Quality Criteria	FC	FC	FC	FC	FC	FC	FC



## 1.0 Summary.

1.1 Major Conclusions and Findings. Modified Plan A was designated as the National Economic Development (NED) plan because it provides for economically efficient improved navigational capabilities at Pascagoula Harbor, Mississippi. In addition, this plan does not have significant adverse impacts on the environment. In the DEIS, Plan E had been designated as the NED plan, however, further coordination with the Tennessee Gas Transmission Company indicated that the Tenneco site would be unavailable for use as a disposal site, therefore Plans C and E described in the following are non-implementable.

Disposal of dredged materials in the open water sites within Mississippi Sound, shallow waters near Horn Island and the return of effluent from the proposed upland disposal sites back into waters of the United States have been evaluated following the 404(b) Guidelines, in compliance with the Clean Water Act of 1977, 33 U.S.C. 1251 et. seq. (See Appendix D to the Main Report). Designation of the Gulf of Mexico disposal site will be necessary under Section 103 of the Marine Protection, Research, and Sanctuaries Act of 1972. By letter dated March 5, 1985 the Environmental Protection Agency has concurred, based on available information, that suitable sites exist within a reasonable distance of the barrier islands and that the site designation process would be accomplished during the Continued Planning and Engineering phase of the study. The tentatively selected plan is consistent to the maximum extent practicable with the State of Mississippi Coastal Zone Management Plan.

1.2 Areas of Controversy. There are no remaining areas of controversy. Serious differences of opinion surfaced during this planning effort primarily concerning the nature, value, and use of the Tenneco site. This is no longer an issue because recent additional information received from the Tennessee Gas Transmission Company (Tenneco) indicates that the Liquified Natural Gas (LNG) facility proposed for this site should be on line prior to the predicted construction date for the proposed action and the site would not be available for consideration as a dredged material disposal site.

1.3 Unresolved Issues. None. Since the Tenneco site would not be available as a disposal site at the projected time of construction, the issue concerning its' jurisdictional nature is no longer relevant to the proposed action.

1.4 Relationship to Environmental Requirements. Refer to Table EIS-1.

1.5 The draft Environmental Impact Statement (DEIS) was filed with EPA on July 27, 1984 and the Final EIS was sent to EPA.

## 2.0 Need For and Objectives of Action.

2.1 Study Authority. Authority for this study is contained in Senate Public Works Committee Resolutions adopted on September 23, 1965, and February 10, 1971 and House Public Works Committee Resolution adopted on June 23, 1971. The resolutions requested feasibility studies to determine

indicated the Tenneco site would be unavailable for use. In addition, further refinements were made in the design of the channels, therefore, Plan A was modified to further include widening of the Pass leg of the Entrance channel to 600 feet; widening of the bends in the channels; and reduction of the Bayou Casotte turning basin radius to 1,150-foot. Based on these refinements Modified Plan A has been tentatively selected based on its performance in addressing the identified public concerns and its positive contributions to the goals of National Economic Development and Environmental Quality. This plan includes deepening all the channels in Mississippi Sound to 42 feet and the Entrance channel to 44 feet, widening of the Gulf leg of the Entrance channel to 550 feet and the Pass leg to 600 feet; widening of the Bayou Casotte channel to 350 feet; widening of the bends in the channels; and providing a 1150-foot turning diameter turning basin just inside the mouth of Bayou Casotte. The Upper Pascagoula channel would be deepened to a point just south of the grain elevator and the Bayou Casotte channel would be deepened to the turning basin. A shallow depth disposal site south of the eastern end of Horn Island would be used for new work and maintenance materials dredged from the entrance channel. The existing upland disposal sites would be used for containment of new work and maintenance materials from the inner Pascagoula and Bayou Casotte harbors. Maintenance material from the Bayou Casotte turning basin would be disposed in the existing site at Greenwood Island. New work material from Bayou Casotte and Upper and Lower Pascagoula channels and Bayou Casotte turning basin would be disposed in a presently undesignated site in the Gulf of Mexico. Maintenance materials from these channels would be placed in the existing sites at Singing River and Greenwood Islands and existing open water disposal sites 3, 4, 6S (6B), 7, 8, and 9 in Mississippi Sound. Although all efforts were made to avoid and minimize environmental impacts, the recommended plan results in the unavoidable loss of four acres of emergent wetland and destruction of two archeological sites which have been determined to be eligible for the National Register of Historic Places. Appropriate mitigation for these impacts has been included in the recommended plan.

If you would like further  
information to this  
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NOTE: Information, displays, maps, etc., discussed in the Pascagoula Harbor Main Report are incorporated by reference in the FEIS.

FINAL  
ENVIRONMENTAL IMPACT STATEMENT  
PASCAGOULA HARBOR, MISSISSIPPI  
NAVIGATION IMPROVEMENT

The responsible lead agency is the U.S. Army Engineer District Mobile.

Abstract The Mobile District has investigated public concerns of the Pascagoula, Mississippi study area related to providing increased widths and depths in the Pascagoula and Bayou Casotte navigation channels. Of the plans initially formulated, five were selected for detailed study along with the "No Action" alternative. All plans considered for detailed study included deepening all the channels in Mississippi Sound to 42 feet and the entrance channel to 44 feet; widening of the Entrance channel to 550 feet; widening of the Bayou Casotte Channel to 350 feet; and providing a 1400-foot turning diameter turning basin just inside the mouth of Bayou Casotte. The Upper Pascagoula channel would be deepened to a point just south of the grain elevator and the Bayou Casotte channel would be deepened to the turning basin. In addition, all plans would use a shallow depth disposal site south of the eastern end of Horn Island for new work and maintenance materials dredged from the entrance channel. The existing upland disposal sites would be used for containment of new work and maintenance materials from the inner Pascagoula and Bayou Casotte harbors. Maintenance material from the Bayou Casotte turning basin would be disposed in the existing site at Greenwood Island. Plan A would dispose of new work materials from Bayou Casotte and Upper and Lower Pascagoula channels and Bayou Casotte turning basin in a presently undesignated site in the Gulf of Mexico. Maintenance materials from these channels would be disposed following present practices, including diked upland and unconfined open water sites in Mississippi Sound. Plan B would dispose of both new work and maintenance materials from these channels and new work material from the turning basin in a presently undesignated site in the Gulf. Plan C would involve disposal of the Bayou Casotte new work material in a diked 257-acre site on property belonging to Tennessee Gas Transmission Company (Tenneco). New work from the Upper and Lower Pascagoula channels would be disposed in an expanded area at the existing Singing River Island. Maintenance materials would be disposed following present practices. Plan D involves the reconstruction of the Grande Batture Islands. An 18,000-foot breakwater would be constructed and the new work materials originating from Bayou Casotte including the turning basin would be disposed north of the breakwater and planted with naturally occurring marsh species. New work materials from Upper and Lower Pascagoula channels would be disposed in an expanded disposal area at Singing River Island. Maintenance materials from all sound channels would be disposed according to current practices. Plan E would dispose of new work material from the Bayou Casotte channel and turning basin in a diked 257-acre site on property belonging to Tennessee Gas Transmission Company. New work from the Upper and Lower Pascagoula Channels would be disposed in a presently undesignated site in the Gulf of Mexico. Maintenance materials from the three channels would be disposed in the site in the Gulf. During review of the draft report, additional coordination with the Tennessee Gas Transmission Company

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FINAL  
ENVIRONMENTAL IMPACT STATEMENT  
PASCAGOULA HARBOR, MISSISSIPPI  
NAVIGATION IMPROVEMENTS

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NOTE: Information gathered during higher level review of the Feasibility Report on Navigation Improvements at Pascagoula Harbor, Mississippi resulted in: (1) a determination that the Tenneco site as described for use in alternative Plans C and E would be unavailable for use as a disposal site therefore these plans are non-implementable at this time; (2) a need for widening the Pass leg of the Entrance channel from the width proposed in the draft report (550 feet) to 600 feet; and (3) a reduction in the size of the turning basin in Bayou Casotte from 1400-foot radius to 1150-foot radius.

These changes caused revisions in selected paragraphs of the EIS with subsequent changes in pagination in the reprinted FEIS. Since the impacts resultant from the recommended plan, Modified Plan A, are less than those described for Plan A in the DEIS, recoordination of the DEIS was not considered necessary.

# ENVIRONMENTAL IMPACT STATEMENT

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US Dept. of the Interior, National Park Service. 1978. Gulf Islands National Seashore, Florida/Mississippi. Final Environmental Statement. 384 pp.

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ALTHOUGH NOT SPECIFICALLY REFERENCED IN THE TEXT, THE FOLLOWING DOCUMENTS WERE ALSO USED IN THE PREPARATION OF THIS REPORT:

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dredged material disposal islands (Plate III, Main Report). However, deepening the Pascagoula-Bayou Casotte navigation complex to 42 feet and widening Bayou Casotte channel and construction of the turning basin do not produce enough suitable new work material to construct the size of island necessary to contain the 50 years of maintenance material. In addition, several state and Federal agencies indicated that they would not support a plan that included island creation. This alternative was, therefore, not carried forward for detailed analysis.

3.1.3e Disposal on Lands Belonging to Standard Oil Company. This option would result in the filling of 300 acres of wetlands characterized by salt marsh hay, black needlerush, three-square, wax myrtle and marsh elder. The environmental impacts associated with this option would be significant and several state and Federal agencies indicated that they would not support a plan that included this option. This alternative was, therefore, removed from detailed analysis late in the planning process.

3.1.3f Disposal of Sandy Material North of Petit Bois Island. This plan would use materials from the Entrance channel in an effort to stabilize Petit Bois Island, which is undergoing erosion. The north shore of the island provides suitable conditions for submerged aquatic vegetation, a resource which is very valuable and not very abundant within the Mississippi Sound area. The environmental impacts associated with this option would prove very detrimental to the ecosystem and therefore, the plan was not carried forward for detailed analysis.

3.2 Plans Considered in Detail. Evaluations performed in the intermediate stage identified five plans which merited further study. These plans, including the "No Action" alternative, made up the final array of alternatives presented in the draft feasibility report and DEIS. During coordination of the draft it became evident that the Tenneco site would be unavailable at the projected time of construction. In addition, refinement of the design of the channels reduced the size of the turning basin and increased the width of the pass leg of the Entrance channel. These changes as made to Plan A are described as Modified Plan A below. Table EIS-2 summarizes information contained in the Main Report related to plan economics, mitigation requirements, and plan designations. See Appendix B to the Main Report for more detailed discussion on the economic analyses.

3.2.1 "No Action" Alternative. Maintenance of the existing project provides waterborne transportation via: (a) an entrance channel 40 feet deep and 350 feet wide from the Gulf of Mexico through Horn Island Pass, including an impounding area for littoral drift, 40 feet deep, 200 feet wide, and about 1,500 feet long adjacent to the channel at the west end of Petit Bois Island; (b) a channel 38 feet deep and 350 feet wide in Mississippi Sound and Pascagoula River to the Louisville and Nashville (L&N) Railroad bridge at Pascagoula, including a turning basin 2,000 feet long and 950 feet wide (including the channel area) on the west side of the river below the railroad bridge; (c) a channel 38 feet deep and 225 feet wide from the ship channel in Mississippi Sound to the mouth of Bayou Casotte, thence 38 feet

Table EIS-2

Summary of Selected Features of Alternative Plans Considered in Detail<sup>1/</sup>

PLAN	ECONOMIC DATA (\$1000)			MITIGATION REQUIREMENT		PLAN DESIGNATION
	ANNUAL COSTS	ANNUAL BENEFITS	B/C RATIO	COE	FWS	
"NO ACTION"	0	0	N/A	N/A	N/A	No Action
PLAN A	3753	24369	6.5	0	7 +	None
PLAN B	3799	24360	6.4	0	7 +	None
PLAN C <sup>2/</sup>	3738	24360	6.5	ND	58 + 251 *	None
PLAN D	6098	24427	4.0	ND	ND	None
PLAN E <sup>2/</sup>	3612	24360	6.7	0	58 + 251 *	None
MODIFIED PLAN A	5404	22342	4.1	6 +	ND	NED

<sup>1/</sup> In preparation of estimates for Modified Plan A quantities of material and unit costs were updated. These updates were not applied to Plans A, B, C, D, or E in preparation of this table.

<sup>2/</sup> Plans C and E determined, during draft review, to be non-implementable  
 + Acres of wetland habitat  
 \* Acres if scrub/shrub habitat  
 ND Not Determined

deep and 300 feet wide for about 1 mile to a turning basin 38 feet deep, 1000 feet wide, and 1,750 feet long; (d) a channel 22 feet deep and 150 feet wide up the Pascagoula River from the L&N Railroad bridge to the Escatawpa River, thence up the Escatawpa River to Highway 63 bridge; and, (e) a channel 12 feet deep and 125 feet wide from the Highway 63 bridge, via Robertson Lake and Bounds Lake, to mile 10 on the Escatawpa River (Plate I, Main Report).

Shoaling from the Entrance channel is removed by hopper dredge and disposed of in an area approximately 2 miles southeast of the eastern end of Horn Island. Materials trapped in the impoundment basin are pumped to an area west of the channel in the Horn Island Pass and have over time created an island locally known as "Sand Island". Dredged material from Mississippi Sound to the mouth of the Pascagoula River and to the mouth of Bayou Casotte is removed with a hydraulic pipeline/cutterhead dredge. Currently, dredged material from the Upper and Lower Pascagoula channels (up to about mile 3) is placed in open water disposal areas west of the channel between miles 3 and 12. The material from about mile 3 to about mile 1.75 is placed in the diked upland disposal area west of the channel (Singing River Island). The inner portion of Pascagoula Harbor up to the L&N Railroad bridge uses the three previously used adjacent diked upland disposal sites west of the turning basin to contain the maintenance material (Double Barrel site). No maintenance dredging is currently required above the railroad bridge. The maintenance material from the Bayou Casotte channel is placed in the open water disposal areas east of the channel. The inner Bayou Casotte Harbor dredged material is placed in the diked upland site (Greenwood Island) located west of the mouth of Bayou Casotte.

The assumption has been made, based on additional information from the Tennessee Gas Transmission Company, that the Tenneco site would be converted to an Liquified Natural Gas (LNG) facility prior to construction of the proposed action. This action has been included in the "No Action" alternative.

The principal difficulties stemming from inadequate widths and depths throughout the existing channels and turning basins for the current size vessels and traffic density would not be alleviated under this alternative.

The liquid and dry bulk carriers transporting commodities from Bayou Casotte and Pascagoula Harbor would continue to light load to move through the existing channels. In addition to this economic handicap this alternative would not alleviate the safety problems caused by the inadequate channels. These safety problems combined with the large volumes and highly toxic and flammable nature of many of the materials moving through the harbor render such risk highly hazardous.

**3.2.2 Channel Modification Alternatives.** Alternatives A, B, C, D, and E provide for: (a) an entrance channel 44 feet deep and 550 feet wide from the Gulf of Mexico into Horn Island Pass including a 56-foot deep impounding area, within the channel alignment, for littoral drift; (b) a channel 42

feet deep and 350 feet wide in Mississippi Sound and Pascagoula River to just downstream of the grain elevator; (c) a channel 42 feet deep and 350 feet wide in Mississippi Sound to the mouth of Bayou Casotte; and (d) provision of a 42-foot deep, 1400-foot radius turning basin inside the mouth of Bayou Casotte at the northern end of the deepened channel. Modified Plan A provides for: (a) an entrance channel 44 feet deep and 550 feet wide from the Gulf of Mexico into Horn Island Pass (Gulf leg), a 600-foot wide channel within Horn Island Pass (Pass leg); (b) a channel 42 feet deep and 350 feet wide in Mississippi Sound and Pascagoula River to just downstream of the grain elevator; (c) a channel 42 feet deep and 350 feet wide in Mississippi Sound to the mouth of Bayou Casotte; (d) provision of a 42-foot deep 1150-foot radius turning basin inside the mouth of Bayou Casotte at the northern end of the deepened channel; and (e) widening of the channel bends within Mississippi Sound. The depths indicated are nominal depths, actual depth would include 2 feet advanced maintenance and 2 feet overdepth dredging. In addition, a telephone cable and 3 hydrocarbon transmission pipelines would be relocated. For a more detailed description refer to pages 71-72 of the Main Report.

The plans considered in detail utilize various combinations of disposal areas and are presented in comparative format in Table EIS-3 and described in detail below and on pages \*\*\*\*\* of the Main Report. Recent additional information received from the Tennessee Gas Transmission Company (Tenneco) concerning their proposed development plans for the Tenneco site indicates that by the predicted date of construction of the improvements at Pascagoula the proposed LNG facility should be on line. Therefore, the Tenneco site would not be available for use as a disposal area for the materials to be dredged during construction of the Bayou Casotte turning basin. Plans C and E, as discussed below, are therefore not implementable.

**3.2.3 Plan A.** This alternative involves the disposal of approximately 2.9 million cubic yards of new work and approximately 24 million cubic yards maintenance material, over the 50 year project life, dredged from the entrance channel in the littoral zone south of Horn Island. Dredging in this area would be accomplished utilizing a shallow draft hopper dredge, bottom dump barges, or hydraulic pipeline/cutterhead dredge.

New work and maintenance materials from the inner harbor area of the Pascagoula River would be placed in the existing disposal sites on Lowery Island ("Double Barrel" site) and Singing River Island. Maintenance material dredged from Mile 1.8 to Mile 3.0 in the Upper Pascagoula channel would be placed in the existing disposal site at Singing River Island. No new work dredging would be performed within the Bayou Casotte inner harbor. Maintenance material from the inner Bayou Casotte would be placed in the existing disposal site at Greenwood Island. Dredging of the inner harbors would be done by hydraulic pipeline/cutterhead dredge. These disposal activities are common to Plans A, B, C, D, E, and Modified Plan A.

New work from the Upper and Lower Pascagoula channels and Bayou Casotte turning basin would be disposed in a site to be designated in the Gulf of

TABLE EIS-3  
Channel Segment, Disposal Action and Alternative Plan Matrix

Segment/ Entrance Channel	No Action	Alternatives				
		Plan A	Plan B	Plan C	Plan D	Plan E
	NW: N/A	Horn Island shallow water disposal sites	Horn Island shallow water disposal sites	Horn Island shallow water disposal sites	Horn Island shallow water disposal sites	Horn Island shallow water disposal sites
	O&M: Gulf of Mexico	Horn Island shallow water disposal sites	Horn Island shallow water disposal sites	Horn Island shallow water disposal sites	Horn Island shallow water disposal sites	Horn Island shallow water disposal sites
Lower Pascagoula Channel	NW: N/A	Gulf disposal	Gulf disposal	Singing River	Singing River	Gulf disposal
	O&M: Open water	Open water sites 7, 8, 9, 10	Gulf disposal	Open water sites 7, 8, 9, 10	Open water sites 7, 8, 9, 10	Open water sites 7, 8, 9
Upper Pascagoula Channel	NW: N/A	Gulf disposal	Gulf disposal	Singing River	Singing River	Gulf disposal
	O&M: Singing River Open water	Singing River Sites 5, 6	Gulf disposal	Singing River Sites 5, 6	Singing River Sites 5, 6	Singing River Open water site 66
Pascagoula Inner Harbor	NW: N/A	Double Barrel Singing River	Double Barrel Singing River	Double Barrel Singing River	Double Barrel Singing River	Double Barrel Singing River
	O&M: Double Barrel Singing River	Double Barrel Singing River	Double Barrel Singing River	Double Barrel Singing River	Double Barrel Singing River	Double Barrel Singing River
Bayou Casotte Channel & Basin	NW: N/A	Gulf disposal	Gulf disposal	Tenneco	Grande Batture	Gulf disposal
	O&M: Greenwood Island Open Water	Greenwood Island Sites 1, 2, 3, 4	Gulf disposal	Greenwood Island Sites 1, 2, 3, 4	Greenwood Island Sites 1, 2, 3, 4	Greenwood Island Open water 3, 4
Bayou Casotte Inner Harbor	NW: N/A	N/A	N/A	N/A	N/A	N/A
	O&M: Greenwood Island	Greenwood Island	Greenwood Island	Greenwood Island	Greenwood Island	Greenwood Island

Mexico. Dredging in these channels would be done by hydraulic pipeline/cutterhead dredge with the dredged material put into bottom dump barges for transportation to a Gulf of Mexico disposal area to be sited within a reasonable distance of the barrier islands. Maintenance materials from these channels would be disposed utilizing the existing upland sites and open water sites in Mississippi Sound. Maintenance from the Bayou Casotte turning basin would be disposed in the existing site at Greenwood Island. Maintenance dredging would be accomplished with a hydraulic pipeline/cutterhead dredge (Plate IV, Main Report).

Implementation of this plan would utilize approximately 216 acres of existing diked disposal area at the Double Barrel and Greenwood Island sites and approximately 333 acres of diked disposal area on Singing River Island as designed in the Long-term Disposal Management Plan prepared for the Mississippi Coastal Program Pascagoula Special Management Area planning. Approximately 6,000 acres of Mississippi Sound bottoms would be impacted during disposal operations and 1,400 acres of channel bottoms disturbed during dredging. Approximately 55 acres of shallow bay bottoms would be converted to deep bottoms with the widening of Bayou Casotte. Construction of the turning basin would impact approximately 19 acres on the southeast edge of Greenwood Island and 40 acres of shallow bay bottoms which would be converted to deep bottoms. Of the 19 acres, approximately 8 to 10 are jurisdictional wetlands. In addition, two archeological sites which are eligible for inclusion in the National Historic Register would be destroyed. Disposal in the littoral zone and Gulf of Mexico would disturb a currently undetermined number of bottoms respectively.

The disposal in an area south of Horn Island would result in littoral nourishment of Horn Island and is an effort to retard the erosion of the eastern tip of this island. This is in response to suggestions made by the staff of the Gulf Islands National Seashore and other coastal interests in Mississippi. The disposal of these materials has been evaluated following the 404(b) Guidelines in compliance with the Clean Water Act of 1977, 33 U.S.C. 1251 et. seq. (See Appendix D to the Main Report). The Gulf of Mexico disposal area would have to be designated following guidelines specified in the Marine Protection, Research and Sanctuaries Act of 1972. Information obtained during the Corps Mississippi Sound and Adjacent Areas Study (USACE, 1984) indicated that large areas 5 - 14 miles offshore of the barrier islands and outside of the safety fairways had characteristics which would be compatible with materials to be dredged from Mississippi Sound. Sediments are similar in nature and the benthic communities of these offshore areas contain species in common with the areas to be dredged in the Sound. No known fishing concentration areas, including artificial reefs, spawning or nursery grounds, or migratory routes, are located within these areas. In addition the water depths of these areas, approximately 50 feet would allow the materials to settle and spread through the water column rather than mound in any one area. Current velocities and circulation patterns in these areas would also tend to spread the material in thinner layers such that the impacts to the benthos would be lessened. The Environmental Protection Agency, by letter dated March 5, 1985, concurred that



available information suggests the possibility of suitable sites within an approximate 14 mile radius of the barrier islands. They also concurred that site specific designation studies could be accomplished during the post authorization phase of the proposed project.

3.2.4 Plan B. Construction and maintenance of the entrance channel and inner harbor areas would be the same as under Plan A. All new work and maintenance materials from the Upper and Lower Pascagoula and Bayou Casotte channels and Bayou Casotte turning basin would be disposed in an undesignated site in the Gulf of Mexico (Plate V, Main Report). This would be accomplished with a hydraulic pipeline/cutterhead dredge and bottom dump barges.

Implementation of this plan would result in impacts similar to those of plan A with the exception of the disturbance 6,000 acres of Mississippi Sound bottoms during maintenance activities. In addition the undesignated Gulf of Mexico site would be disturbed on an annual basis during maintenance activities of the Upper and Lower Pascagoula and Bayou Casotte areas.

3.2.5 Plan C. Construction and maintenance of the entrance channel and inner harbor areas would be the same as under Plan A. New work from the Bayou Casotte channel and turning basin would be disposed in a diked 257-acre site located on property belonging to Tennessee Gas Transmission Company (Tenneco site). The actual disposal area is approximately 200 acres with the dike occupying the remainder of the area. New work material from the Upper and Lower Pascagoula Channels would be used to enlarge the existing disposal area on Singing River Island. Maintenance materials from these channels would go into the disposal areas on Singing River and Greenwood Islands and into open water areas as is current practice. Dredging and disposal would be accomplished using a hydraulic pipeline/cutterhead dredge. The existing dike design at the Tenneco site would be utilized with the overflow weir in the southeastern corner of the site. The return water would flow through an existing 400-foot long ditch, which bisects the wetlands to the south of the site, into Mississippi Sound (Plate VI, Main Report).

In addition to the impacts attributed to Plan A, the implementation of this plan would increase the size of the existing disposal area at Singing River Island by 50 acres including wetlands southwest of the existing dikes. Approximately 257 acres of shrub-scrub wetland on the Tennessee Gas Transmission Company property would be converted to high land with the disposal of new work materials from Bayou Casotte.

3.2.6 Plan D. Construction and maintenance of the entrance channel and inner harbor areas would be the same as under Plan A. New work from the Upper and Lower Pascagoula channels would be placed on an enlarged Singing River Island site as described in Plan C. New work from the Bayou Casotte channel and turning basin would be used in nourishment of the Grande Batture Islands. A hydraulic pipeline/cutterhead dredge would be used to move the materials to the disposal site. An 18,000-foot stone breakwater would be constructed along an alignment that approximates the historic alignment of

the islands and the dredged material placed north of this breakwater in an 810 acre area. Marsh grasses would be planted on the dredged material in an effort to stabilize the area and create wetlands. A work channel to the disposal site, with a 9-foot nominal depth, would be constructed from the Gulf Intracoastal Waterway to the area of the Grande Batture (Plate VII, Main Report). These materials would be used to form the base of the breakwater. Disposal of maintenance materials from the Pascagoula and Bayou Cassotte channels and Bayou Casotte turning basin would be disposed according to current practices utilizing the existing sites at Singing River and Greenwood Islands and various open water sites along the channel alignment.

The impacts of this Plan would be similar to Plan C with the exception of the 257 acres at the Tennessee Gas Transmission Company property. Instead the implementation of this plan would result in the establishment of approximately 810 acres of wetlands at Grande Batture. The provision of the breakwater and subsequent marsh development would also help to reduce the erosion potential to the Point aux Chenes marshes thereby aiding in their preservation. Additional impacts to Mississippi Sound bottoms would occur with the construction of the breakwater and adjacent wetland.

3.2.7 Plan E. Construction and maintenance of the entrance channel and inner harbor areas would be the same as under Plan A. New work from the Bayou Casotte Channel would be placed in a currently diked 257-acre site belonging to Tennessee Gas Transmission Company as in Plan C. New work from the Upper and Lower Pascagoula channels would be disposed in an as yet to be designated site in the Gulf. Maintenance materials dredged from the Bayou Casotte and Upper and Lower Pascagoula channels would be disposed in the site in the Gulf. A hydraulic pipeline/cutterhead dredge would be used with bottom dump barges transporting the materials to the Gulf site (Plate VIII, Main Report).

In addition to the impacts attributable to Plan B, implementation of this plan would convert approximately 257 acres of shrub-scrub wetland on the Tennessee Gas Transmission Company property to higher land.

3.2.8 Modified Plan A. This alternative involves the disposal of approximately 3.3 million cubic yards of new work and approximately 34 million cubic yards maintenance material, over the 50 year project life, dredged from the entrance channel in the littoral zone south of Horn Island. Dredging in this area would be accomplished utilizing a shallow draft hopper dredge, bottom dump barges, or hydraulic pipeline/cutterhead dredge. New work and maintenance materials from the inner harbor area of the Pascagoula River would be placed in the existing disposal sites on Lowery Island ("Double Barrel" site) and Singing River Island. No new work dredging would be performed within the Bayou Casotte inner harbor. Maintenance material from the inner Bayou Casotte would be placed in the existing disposal site at Greenwood Island. Dredging of the inner harbors would be done by hydraulic pipeline/cutterhead dredge. The return water from the upland disposal sites has been evaluated following the 404(b) Guidelines in compliance with

the Clean Water Act of 1977, 33 U.S.C. 1251 et. seq. (See Appendix D to the Main Report).

New work from the Upper and Lower Pascagoula channels and Bayou Casotte channel and turning basin would be disposed in a site to be designated in the Gulf of Mexico. Dredging in these channels would be done by hydraulic pipeline/ cutterhead dredge with the dredged material put in bottom dump barges for transportation to the Gulf of Mexico disposal site within a reasonable distance of the barrier islands. Maintenance materials from these channels would be disposed utilizing the existing upland sites on Singing River and Greenwood Islands and open water sites 3, 4, 6S(6B), 7, 8, and 9 along the channel alignment. Maintenance from the Bayou Casotte turning basin would be disposed in the existing site at Greenwood Island. Maintenance dredging would be accomplished with a hydraulic pipeline/cutterhead dredge (Plate IV, Main Report). The disposal of these materials and the return water from the Greenwood Island site have been evaluated following the 404(b) Guidelines in compliance with the Clean Water Act of 1977, 33 U.S.C. 1251 et. seq. (See Appendix D to the Main Report).

Implementation of this plan would utilize approximately 216 acres of existing diked disposal area at the Double Barrel and Greenwood Island sites and approximately 333 acres of diked disposal area on Singing River Island as designed in the Long-term Disposal Management Plan prepared for the Mississippi Coastal Program Pascagoula Special Management Area planning. Approximately 4,200 acres of Mississippi Sound bottoms are designated in the open water sites of which approximately 1,860 acres would be impacted during each maintenance cycle. Approximately 1,400 acres of channel bottoms would be disturbed during dredging. Approximately 55 acres of shallow bay bottoms would be converted to deep bottoms with the widening of Bayou Casotte. Construction of the turning basin would impact approximately 4 acres of jurisdictional wetlands on the southeast edge of Greenwood Island and 25 acres of shallow bay bottoms which would be converted to deep bottoms. Further refinement of the turning basin design in Continued Planning and Engineering phase could result in a decrease in this acreage or possible avoidance of the area. In addition, two archeological sites which have been determined eligible for inclusion in the National Historic Register would be destroyed. Disposal in the littoral zone and Gulf of Mexico would disturb a currently undetermined number of bottoms respectively.

The disposal in an area south of Horn Island would result in littoral nourishment of Horn Island and is an effort to retard the erosion of the eastern tip of this island. This is in response to suggestions made by the staff of the Gulf Islands National Seashore and other coastal interests in Mississippi. The disposal of these materials has been evaluated following the 404(b) Guidelines in compliance with the Clean Water Act of 1977, 33 U.S.C. 1251 et. seq. (See Appendix D to the Main Report). The Gulf of Mexico disposal area would have to be designated following guidelines specified in the Marine Protection, Research and Sanctuaries Act of 1972. Information obtained during the Corps Mississippi Sound and Adjacent Areas Study (USACE, 1984) indicated that large areas 5 - 14 miles offshore of the barrier

islands and outside of the safety fairways had characteristics which would be compatible with materials to be dredged from Mississippi Sound. Sediments are similar in nature and the benthic communities of these offshore areas contain species in common with the areas to be dredged in the Sound. No known fishing concentration areas, including artificial reefs, spawning or nursery grounds, or migratory routes, are located within these areas. In addition the water depths of these areas, approximately 50 feet would allow the materials to settle and spread through the water column rather than mound in any one area. Current velocities and circulation patterns in these areas would also tend to spread the material in thinner layers such that the impacts to the benthos would be lessened. The Environmental Protection Agency, by letter dated March 5, 1985, concurred that available information suggests the possibility of suitable sites within an approximate 14 mile radius of the barrier islands. They also concurred that site specific designation studies could be accomplished during the post authorization phase of the proposed project.

#### 4.0 Affected Environment

4.1 General Environmental Conditions. The Pascagoula Harbor-Bayou Casotte Navigation Complex is located in Jackson County in southeastern Mississippi. Pascagoula, the largest city within the county, has a population of approximately 118,000 and serves as a major industrial and market center. The Pascagoula study area encompasses the region bounded by the Pascagoula River on the west, the Point aux Chenes marshes on the east, Interstate Highway I-10 on the north, and the Gulf of Mexico on the south. Within this area, the navigation complex is divided into six segments: Pascagoula Entrance Channel (gulf and pass legs), Lower Pascagoula Channel, Upper Pascagoula Channel, and Bayou Casotte Channel, Pascagoula Inner Harbor, and Bayou Casotte Inner Harbor (Plate I, Main Report).

The major biotic communities within the project area are nearshore Gulf of Mexico, estuarine and palustrine open waters, emergent wetlands, aquatic beds, barrier island, bottomland and upland forests, agricultural, and urban. Numerous game animals and migratory waterfowl utilize the vegetative habitats. Commercial fisheries utilize the wetland and open water areas throughout their life cycles. A number of threatened or endangered species may occur within the study area.

4.2 Significant Resources. The following paragraphs summarize the significant resources occurring within the study area which may be impacted by the proposed action. For a more detailed discussion, the reader is referred to the Existing Conditions Section of the Main Report and to the Mississippi Sound and Adjacent Areas Study (USACE, 1984).

4.2.1 Vegetation. Emergent wetlands, including estuarine and palustrine forms, comprise approximately 16,500 acres of the study area. Freshwater marshes are present north of the Interstate Highway 10. These freshwater marshes intergrade with the extensive brackish marsh community of the Pascagoula River delta. These brackish marshes intergrade with the saline

marshes dominated by black needlerush with smooth cordgrass locally abundant in the intertidal zone. Approximately 700 acres of submersed grassbeds were identified within the study area in 1979. These beds are restricted to shallow areas of less than 6 feet in depth, primarily along the northern shores of Horn and Petit Bois Islands.

Scrub/shrub wetland communities occur on topographic rises within emergent wetlands or as a transition zone between the marsh and adjacent forest areas or on previously disturbed areas. The Tenneco site is an example of the latter. The flat eastern portion of the site is dominated by a marsh elder (Iva frutescens) and sea myrtle (Baccharis halimifolia) midstory with an understory of goldenrod (Solidago sp.). The higher western portion is dominated by wax myrtle (Myrica cerifera) and stands of Cogongrass, locally known as 'Jap Grass' (Imperata cylindrica) and torpedo grass (Panicum repens). The lower southeastern-most portion traps rainwater after heavy rains and contains saltmarsh bulrush (Scirpus robustus), smartweed (Polygonum sp.), and saltgrass (Distichlis spicata).

Forested wetlands occur on the flood plain of the Pascagoula and Escatawpa Rivers and their tributaries. Within the study area, evergreen needle-leaved forests predominate with broadleaf evergreen and deciduous forests making up the remainder of the forested wetlands in the study area. Upland forested areas are characterized by species of the longleaf pine-oaks association and are usually xeric sandy sites above the 10-foot contour. Other upland forested areas include species of the moist pineland association and may form a strip between the forested wetlands and the more upland long-leaf pine-oaks forest.

In addition to fringing marshes along the northern shores, the barrier islands support two unique habitats; the maritime strand forest and the beach-dune associations. The land-water interface along Horn and Petit Bois Islands is characterized by beach conditions which intergrades into extensive dune conditions vegetated by saw palmetto, seaside rosemary, sea oats, morning glory, and pennywort. Landward of the dune system, the longleaf pine-oaks association is modified, consisting of fewer plants adapted to more rigorous growing conditions, such as coarse white sand and salt spray.

**4.2.2 Aquatic Resources.** Estuarine and Gulf of Mexico open water areas dominate the delineated Pascagoula Harbor study area. These areas range in depth from less than 1 foot MLW to depths greater than 60 feet and contain a variety of resources important to the functioning of the ecosystem.

Intertidal and subtidal bottoms are populated by communities of macrofauna whose structure is dependent upon substrate, salinity, temperature, depth and ecological relationships. Of the seven benthic communities which have been identified within the study area, the open sound, muddy-sand community occupies over 68 % of the study area (USACE, 1982).

Approximately 570 acres of oyster reefs are located within the study area however these are restricted to Point aux Chenes Bay, Bangs Lake, and an area near the mouth of the West Pascagoula River.

The major fishes landed along the Mississippi Gulf Coast are anchovies, menhaden, mullet, croakers, shrimp, and blue crab. Jackson County, primarily the ports of Pascagoula and Moss Point, receives greater than 85% of all Mississippi landings, including all industrial fish (menhaden), 95% of the mullet, trout, and red snapper, and 74% of the croakers landed. In 1983, the landings through the ports of Pascagoula and Moss Point had a value of \$23.2 million and consisted of 68% menhaden, 29% croaker, 1% red snapper, and 1% shrimp. These species are estuarine dependent, i.e., they spend part or all of their lives in estuaries. A typical estuarine-dependent species spawns in the Gulf of Mexico, and the larvae are then carried into the estuaries where they mature. The stages from the egg to juvenile, during which transport from offshore waters to low salinity areas is accomplished, is probably the most critical of all in the life histories of the important fishery organisms of the Mississippi Gulf Coast. The threat to individuals during this time may be broken down into three distinct phases: (1) transport from the offshore waters to the vicinity of the tidal passes or bay mouths; (2) transport through the passes into the bays; and (3) distribution within the bays after entrance has been obtained (Gunter, 1967). Since these forms are typically incapable of sustained locomotion, any significant increase or decrease in flows through the barrier island pass could impact the migration of these forms.

The mainland margins of the Sound, the margins of Horn and Petit Bois Islands, and the grassbeds of these barrier islands serve as the dominant nursery grounds during spring and summer. In autumn these areas are still important but usage is not as heavy due to the seaward migration of many late juveniles (Benson, 1982 and USACE, 1984).

**4.2.3 Wildlife Resources.** A number of amphibians and reptiles occur in the diverse habitats of the study area, including salamanders, frogs, toads, snakes, and turtles. One species of note within the study area is the yellow-blotched sawback turtle which is restricted to the Pascagoula River drainage system. Five species of sea turtles are found in nearshore Gulf waters. The coastal marshes, swamps, islands, and beaches of the study area support large populations of passerine birds, waterfowl, wading birds, and shore birds. Several active nesting sites are located within the study area. A number of coastal mammals may be found in the project area including squirrel, nutria, muskrat, and numerous other rodents. Marine mammals which utilize the sound and offshore area include dolphins, manatee, and several species of whales.

**4.2.4 Endangered and Threatened Species.** The study area is within the reported range of a number of endangered and threatened species including the American alligator, Atlantic loggerhead turtle, green sea turtle, eastern indigo snake, peregrine falcon, bald eagle, brown pelican, Bachman's warbler, Florida panther, Atlantic sturgeon, the southern coal

kink, rainbow snake, yellow-blotched sawback turtle, black pine snake, and Florida black bear. The critical habitat of the Mississippi Sandhill Crane is within Jackson County.

.2.5 Air Quality. Air quality for the entire State of Mississippi is considered good. The Pascagoula-Moss Point area is in total compliance with Mississippi State standards.

.2.6 Water Quality. The Port of Pascagoula area, comprised of the Escatawpa River to Mile 10, the east and west Pascagoula Rivers to Mile 2 below the confluence with the Escatawpa River and Bayou Casotte, is recognized to have one of the worst water quality problems within the State of Mississippi (Mississippi Bureau Pollution Control (MBPC), 1982). The State of Mississippi has recognized the severity of the problem on the Escatawpa River near Moss Point by reducing the dissolved oxygen (DO) standard from 5.0 milligrams per liter (mg/l) to 3.0 mg/l. Bayou Casotte has been recognized by the State of Mississippi as having DO and bacteria problems related primarily to the Pascagoula/Bayou Casotte Sewage Treatment Plant.

nutrient, heavy metal, pesticide, and hydrocarbon concentrations in the waters of the study area have not been reported in excess of Environmental Protection Agency (EPA) or State of Mississippi water quality standards.

Salinity values within the study area are highly variable. The system is well-mixed throughout the water column except within the navigation channels. Salinities in the nearshore Gulf of Mexico are more oceanic in nature ranging around 29 to 35 ppt with stratification being temporarily variable (Kjerfve, 1983).

.2.7 Circulation. Circulation patterns within the study area are controlled by astronomical tides, winds, and freshwater discharges. In Mississippi Sound and the adjacent gulf waters, the average tidal range is 1.5 feet with a predominant diurnal period of 24.8 hours. The effect of the wind on circulation patterns is significant. A wind with an eastern component induces a general westward current. Winds with a western component set up a general eastward circulation pattern in the sound. Winds with dominant north and south components have minimal effect on overall circulation patterns. Freshwater inflows have a slight effect on the overall circulation patterns as induced by the tides and winds. Comparison of high inflow conditions to low inflow conditions show the same general circulation patterns with an increase in velocities during high freshwater inflow. Water velocities range between 0 to 3 feet per second (fps) in the barrier island passages and between 0 to 0.8 fps in the sound. Wave intensity on the Mississippi-Alabama shelf is low to moderate with wave periods ranging from three to eight seconds and wave heights rarely over 7 feet. However, hurricane or storm conditions may produce larger waves (USACE, 1984).

.2.8 Sediment Quality. Bottom sediments along the navigation channel range from silt and clay/muds (less than 62 microns) to fine to medium sands. Sediment quality within the Pascagoula-Bayou Casotte area indicates

...the highly polluted areas including Lake Yallahs, the former site of the largest oil refinery plant on the Gulf of Mexico, the former Bayou Cassette Harbor north of the Mississippi Chemical Company plant (Little and Lytle, 1982; 1983). Heavy metals have been identified within the sediments of the navigation channels. Concentrations of these contaminants decrease with increasing distance from the industrial areas (Cochran, 1983).

4.2.0 Groundwater Resources. There are three main freshwater bearing aquifers in the coastal area of Jackson County. The base of the freshwater zone varies from less than 1,000 feet to more than 2,000 feet below sea level in Jackson County (Baughman et al., 1976). Jackson County uses more than 50 MGD from ground water sources for municipal and industrial purposes.

Dissolved solids concentrations are variable and generally increase with depth. Chloride concentrations in water from the Pascagoula Formation, in the vicinity of Pascagoula, exceeds 300 mg/l and have steadily increased over the years. Increases in chloride concentration are an indicator of saltwater encroachment in the area, resulting from heavy withdrawals. The Mississippi Bureau of Pollution Control (MBPC, 1982), has identified the Pascagoula and Moss Point areas as having problems resulting from overpumping.

4.2.1 Land Resource and Use. Of the land area within the designated project area, over 10,000 acres are emergent wetlands, approximately 9,000 acres are upland hardwood forests, and 1,700 acres are classified as upland or mixed forest. Agricultural lands occupy approximately 600 acres and industrial material disposal areas approximately 350 acres. The remaining 11,000 acres are considered to be either urban or industrial.

The barrier islands of the northern Gulf of Mexico are in an erosion/deposition cycle which results in the westward migration of the islands through time. This is especially evident with Petit Bois and Horn Islands. Early in the 13th Century, Dauphin and Petit Bois Islands were one island. In about 1848 the island was breached and Petit Bois Pass has widened and migrated westward since this time (Hardin et al., 1975). The operation and maintenance of the Federally authorized project for Pascagoula impinges upon this westward migration in a manner such that dredging of the Entrance Channel interrupts the deposition at the western end of the island. Rather than migrating, the island is getting smaller through time.

4.2.11 Demography. In 1980, the population of Jackson County was 118,015, representing an increase of about 34 percent over 1970 levels compared to an increase of about 14 percent for the State of Mississippi during this period. Jackson County is the Pascagoula-Moss Point Metropolitan Statistical Area and about four out of five residents are classified as urban.

Population projections for Jackson County indicate an increasing trend in population to the year 2040. During this period, the area is expected to increase its population approximately 48.8 percent (US Dept Commerce, Bureau



should not be significant. There would be no long-term noise impact on wildlife.

5.16 Aesthetics. Under the "No Action" alternative the aesthetics of the area would remain in a similar condition to that existing currently. Implementation of any of Alternative Plans A, B, C, D, E, or Modified Plan A would help to maintain the excellent aesthetic appeal of the Horn Island shoreline. Implementation of Plan D would improve the aesthetics of the Point aux Chenes - Grand Bay area by reducing the erosion currently consuming the wetland areas. Use of the existing upland disposal sites on the Tennessee Gas Transmission Company property would not significantly impact the aesthetic quality of the area since these areas are located in a highly industrialized region.

5.17 Transportation. Under the "No Action" alternative transportation through the Ports of Pascagoula and Bayou Casotte would continue to be restricted by the 38-foot channel. Implementation of any of the alternative plans would greatly enhance transportation facilities in the port. Other transportation facilities would not be adversely affected by any of the plans. Implementation of Plan D would enhance the opportunities of the commercial/recreational fleet in Bayou Cumbest by providing protection to the Point aux Chenes area.

5.18 Public Facilities and Services. Public facilities and services in Pascagoula would not be adversely affected by any of the plans considered in detail.

5.19 Cultural Resources. The "No Action" alternative would continue to have possible impact on the archeological sites at Greenwood Island. Construction of any of the alternatives would result in the destruction of two sites, 22Ja516 and 22Ja618, on Greenwood Island during the excavation of the Bayou Casotte turning basin. These sites have been determined to be eligible for the National Register. Consultation with the Mississippi State Historic Preservation Officer concerning archeological data recovery will be conducted prior to construction.

6.0 Summary of Mitigation Measures. Throughout the planning for the navigation improvements for Pascagoula Harbor and Bayou Casotte, efforts have been made to incorporate "mitigation" into the project. As defined in the CEQ's Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (NEPA), "mitigation" includes: (a) avoiding the impact altogether by not taking a certain action or parts of an action; (b) minimizing impacts by limiting the degree or magnitude of the action and its implementation; (c) rectifying the impact by repairing, rehabilitating, or restoring the affected environment; (d) reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; (e) compensating for the impact by replanting or providing substitute resources or environments (40 CFR Parts 1500-1508).

essary, they would be performed during the site designation studies in post authorization phase of the study.

Groundwater Resources. Under the "No Action" alternative groundwater sources would continue to decline due to the projected trend for increasing population for Jackson County.

significant adverse impacts to these resources thru salt wedge intrusion increased industrialization would occur with construction of any of the alternatives. Since the channel depths are proposed to be deepened by only 4 feet it is not felt that a significant landward movement of the salt wedge would occur. The Bayou Casotte - Pascagoula Harbor complex is already highly industrialized and it is not likely that deepening the channel would result in a massive influx of water dependent industries.

0 Land Resource and Use. All plans could induce further growth in the Pascagoula-Bayou Casotte industrial area. A Special Management Plan (SMA) being developed thru the Mississippi Coastal Management Program which will serve to balance industrial development with conservation/preservation of coastal resources. Under the "No Action" alternative the Tenneco site would have been industrialized and Horn Island would continue to erode at its eastern end. Implementation of any of the plans would tend to alleviate erosion of Horn Island.

1 Demography. None of the plans considered in detail would have a significant impact on the demographic characteristics of the area.

2 Economy. Under the "No Action" alternative the economy would be expected to follow projected trends. Since the economy of Jackson County is strongly dependent upon ship building and port related activities implementation of any of the alternative plans would enhance the economic outlook for the area.

3 Community Cohesion. None of the plans considered in detail would have an effect on community cohesion.

4 Recreational Opportunities. Under the "No Action" alternative recreational opportunities would continue to be available. Implementation of any of the alternative plans would help to stabilize the opportunities offered by the Gulf Islands National Seashore on Horn Island. Implementation of Plan D would enhance recreational opportunities in the Point aux Chenes Bay. Fishing would be enhanced by the provision of reefal habitat with construction of the breakwater along the Grande Batture region.

5 Noise. For the "No Action" alternative the existing noise levels in the project area would remain the same. Construction and maintenance of any of the alternative Plans A, B, C, D, E, or Modified Plan A would cause elevated background noise levels due to the equipment used. The elevated noise levels would be of a temporary nature and since much of the area is industrial in nature or removed from inhabited areas the elevated levels

Modified Plan A would not result in significant impacts to circulation in Mississippi Sound because these sites are not considered for use.

Deepening and widening the channels causes slight changes in current velocities within the channel themselves but the changes are not considered significant. Further studies are being conducted to determine if these modifications to the system would cause changes in the flux of water into and out of this area of Mississippi Sound.

Disposal in the region south of Horn Island is not expected to cause any impacts to the circulation patterns of the Gulf or changes in the littoral drift pattern. Disposal in the yet to be designated area in the Gulf of Mexico (Alternative Plans A, B, E, or Modified Plan A) is not expected to cause any impacts to the circulation patterns in the area.

5.8 Sediment Quality. Clay sediments, similar to those present in the inner harbor, Upper and Lower Pascagoula, and Bayou Casotte channels, have a high capacity for retaining pollutants discharged into the water column. Removal of these sediments with their bound contaminants during dredging would improve the sediment quality of the channel areas. Upland disposal of these sediments in the existing sites on Double Barrel, Singing River and Greenwood Islands would place the sediments in an oxidizing environment which would tend to hasten the degradation process (this would apply to all alternatives being considered). This phenomena would also apply to alternative plans C, D, and E with the effect being even more positive due to size of the disposal areas.

Another equally valid enhancement concept involves the covering of contaminated sediments with clean sediments. Alternative plans C, D, and E involve the confined disposal of materials from the Bayou Casotte turning basin. Research indicates that most contaminants in this area are confined to the top 10 inches of the sediment (Lytle and Lytle, 1983). This material would be dredged and disposed of first and would be covered with the remainder of the materials from widening and deepening of the channel. This would remove any contaminants from availability to organisms inhabiting an area.

Gulf disposal of materials in Plans A, B, E, and Modified Plan A would remove the sediments from the estuarine system but would make any contaminants potentially available to gulf forms. However, elutriate analyses indicate the contaminants would remain bound to the sediments and would only be available to organisms which might feed on the deposited material. In addition, the sediments would have been diluted by the time they settled to the bottom so that the contaminant concentrations would be less at the proposed disposal site. Bioassays performed on sediments from the lower Bayou Casotte inner harbor indicated that the sediments were not toxic to the benthic organisms tested (Lytle and Lytle, 1983) and therefore should pose no adverse impact to the offshore environment. Bioaccumulation studies have not been performed to indicate whether magnification of contaminants through the food chain would occur. Should these be deemed

mounding it not expected to pose a problem. More analyses would be necessary concerning bottom circulation patterns and current velocities to predict these impacts and would be performed during the site designation studies for the site pursuant to section 103 of the Marine Protection, Research, and Sanctuaries Act of 1972, as amended (33 U.S.C. 1251). By letter dated March 5, 1985, the Environmental Protection Agency has concurred that possible suitable sites exist within a reasonable distance of the barrier islands and that the specific designation studies should be performed during the post authorization phase of this study.

Placement of riprap during the reconstruction of the Grande Batture Islands (alternative Plan D) would result in temporary localized increases in turbidity. Construction of the diking system north of the riprap and deposition of the dredged materials would cause increases in turbidity and nutrient levels and decreases in dissolved oxygen levels. These impacts however should be localized and temporary in nature. Once stabilized the dredged materials would be planted with emergent and scrub/shrub vegetation to help reduce erosion potential.

Even though some of the sediments of the channel areas are shown to have high levels of some heavy metals and organic pollutants, releases into the water column during dredging and disposal are not expected. Elutriate tests performed in 1983 indicated that the contaminants present in the sediments are bound into the clay lattice structure and are only slightly released during agitation (GeoScience, 1983). In addition, other researchers have suggested that dredging operations in the area, particularly in lower Bayou Casotte inner harbor, have contributed to environmental improvement in that area by removing sediments containing contaminants (Lytle and Lytle, 1993).

Deepening of the channels could possibly result in the wedge of salt water moving landward in the channel and possibly impacting groundwater resources. It is not felt that a significant movement of the salt wedge would occur, however, since the channel depth would only be increased by four (4) feet. Model results indicate that those alternatives utilizing open water sites for disposal of maintenance materials, Plans A, C, D, and Modified Plan A would not result in significant increases in salinity values. Localized changes of 2 ppt or less were noted in the numerical model runs on this project. Alternative plans B and E would have no impact on salinity structure of the project area.

5.7 Circulation. Circulation patterns in the area are controlled primarily by astronomical tides and winds and to a lesser extent by freshwater discharge. Under the "No Action" alternative changes in circulation in the region between the Upper Pascagoula and Bayou Casotte channels would be expected to occur if disposal sites 1, 2, 5, and 6N (6A) were to be continued for use. As described in the DEIS, alternative plans A, C, or D would result in a decrease in flushing in the upper Mississippi Sound region. These sites, however, were discontinued for use in late 1984 and no further impacts to circulation are predicted to occur. Implementation of

changes in salinity are possible. Plans A, B, C, D and E considered use of all the existing open water sites, however, in late 1984 sites 1, 2, 5, and 6N (6A) were deleted from maintenance of the existing project due to projected impacts from continued use. Impacts resulting from the implementation of Plans A, B, C, D, or E, as proposed in the DEIS could have significant impacts on circulation and water quality as predicted in the numerical modelling studies. Under Modified Plan A, which utilizes only sites 3, 4, 6S(6B), 7, 8, and 9, decreases in salinity values are predicted in the channel areas with increases of from 2 to 10 ppt in the vicinity of Round Island. Return waters from existing diked disposal sites would cause temporary localized increases in turbidity and nutrients and decreases in dissolved oxygen within the water column. Short term localized effects of this nature would also be present at the dredge cutterhead.

The disposal of materials in the littoral zone south of Horn Island (all alternatives) would have no long term impact on water quality. The entrance channel materials are primarily scoured coarse grain sands which would settle quickly through the water column to the bottom. This action has been evaluated subject to the Sec 404(b) Guidelines and this evaluation is contained in Appendix D to the Main Report.

Use of the diked disposal sites for materials from the inner harbors (all alternatives) would have similar impacts to the "No Action" alternative. The return of water from these sites would cause short term localized impacts on turbidity, nutrient concentration and dissolved oxygen levels. Elutriate studies indicate that contaminants present in the sediments are tightly bound to the clays and would not become available to the water column during the dredging and disposal process. The return water from the upland disposal sites has been evaluated subject to the Sec 404(b) Guidelines and this evaluation is contained in Appendix D to the Main Report.

The disposal of maintenance materials following current practice (as modified in late 1984) (Modified Plan A) would have impacts similar to the "No Action" alternative. Maintenance quantities are estimated to increase by approximately 5% over maintenance quantities of "No Action" alternative. Therefore, impacts should not be significantly different. The impacts on turbidity, nutrient, and dissolved oxygen levels would be similar to the "No Action" alternative. These actions have been evaluated following the Sec 404(b) Guidelines and this evaluation is included in Appendix D to the Main Report.

Disposal of materials at a site to be specified in the open Gulf of Mexico (Alternative Plans A, B, E, and Modified Plan A) would probably not result in significant impacts to water quality. However, so little information is available concerning natural physical oceanographic processes in this region that it is difficult to postulate on possible impacts. Short term increases in turbidity and nutrient levels would be expected to occur in the vicinity of the dump zone. Decreases in near bottom dissolved oxygen levels would probably occur in this zone as well. Due to the depths of the proposed site

would create a calm water area in Point aux Chenes Bay which could provide habitat for waterfowl and other migratory species.

The discontinuance of open water disposal of impoundment basin materials in the area west of the entrance channel would starve the small dredged material disposal island, locally known as Sand Island. This island currently serves as nesting habitat for a number of species of shorebirds and with it's erosion it's value as nesting habitat would be reduced.

5.4 Endangered and Threatened Species. With the exception of the Atlantic loggerhead and green sea turtles, none of the species designated as endangered or threatened by the Department of Interior or State of Mississippi would be impacted by any of the alternative plans. As mentioned in Section 5.3 of this FEIS there exists a slight possibility that sea turtles could be affected by the disposal of entrance channel materials in the littoral zone of Horn Island. Consultation with the Fish and Wildlife Service and the National Marine Fisheries Service as required under Section 7 of the Endangered Species Act of 1973 was concluded December 21, 1983 and June 25, 1984, respectively. No further endangered species consultation will be required for the recommended plan unless it is modified (see Appendix D to the Main Report).

5.5 Air Quality. For the "No Action" alternative the existing air quality within the project area would remain unchanged. The activities associated with dredging and disposal in all alternative plans would temporarily reduce local air quality levels due to exhaust emissions of the equipment used. The construction of the dikes around the proposed disposal area on the Tennessee Gas Transmission Company property (Plans C and E), the enlargement of Singing River Island (Plans C and D), and the breakwater at Grande Batture (Plan D) would also temporarily reduce air quality in these areas due to exhaust emissions. These impacts are considered to be insignificant and would be limited to the immediate construction area. Any induced development into the area by the project improvement would be subject to State and Federal regulatory procedures to control emissions and protect the air quality.

5.6 Water Quality. For the "No Action" alternative, the existing water quality within the project area would remain the same or possibly improve in some areas while declining in other areas in the future. Completion of the Frederick Street sewage treatment facility will help to improve water quality especially in terms of bacterial contamination. Open water disposal at the existing sites within Mississippi Sound would result in temporary localized increases in turbidity and nutrients and decreases in dissolved oxygen within the water column. Results of the numerical model indicate that the use of open water sites 1, 2, 5, and 6N (6A) could result in the shallowing of these areas to minus 4 feet elevation (State limit). Should this occur, flushing would be reduced in the area between the Upper Pascagoula and Bayou Casotte channels especially during high flow conditions. In addition, the numerical model also indicates that should these disposal areas shallow to the minus 4-foot elevation as predicted

Plan D would utilize the new work materials from the Bayou Casotte channel to nourish the Grande Batture Island chain. A 18,000-foot-long rubble breakwater, with a top elevation approximately 3 feet above MSL would be constructed along the former island shoreline. The dredged materials would be placed in a confined area behind (north) of the breakwater. These actions would convert approximately 810 acres of existing shallow bottoms to hard substrate and wetland habitats. The impact to the shallow bottoms would be insignificant compared to the benefits gained: 1) by construction of a breakwater which would increase habitat diversity; 2) by establishment of 810 acres of wetlands; 3) by providing protection to the pristine Point aux Chenes marshes; 4) by providing salinity conditions in Point aux Chenes Bay conducive to the growth of oysters; and 5) by providing protected open water/marsh areas for larval fish and shellfish.

The nearest oyster reef community is 2.4 miles west of any of the proposed disposal sites and is therefore outside of the sphere of influence of any mud flows from open water disposal operations.

5.3 Wildlife Resources. Under the "No Action" alternative, those wildlife species utilizing the existing upland disposal sites would be impacted on an annual basis during maintenance of the existing project. Hopper maintenance dredging and disposal at the existing Gulf of Mexico site would continue to disrupt possible use of the area by various species of sea turtles during spring and summer. In addition, those species utilizing the Tenneco site would have been displaced by the establishment of the LNG facility.

Widening of Bayou Casotte, construction of the Bayou Casotte turning basin and deepening of the channels under all plans would have no significant impact on wildlife resources. Several of the disposal options, however could have significant impacts as discussed below.

Disposal in the shallow littoral zone south of Horn Island (all plans) could disrupt use of the area by sea turtles. Sea turtles were once common nesters along the gulf shores of the uninhabited barrier islands. However reports of recent nesting activities are rare. If turtles are utilizing the area they would be present April thru November and any activities occurring within the area would tend to disrupt their use of the barrier islands.

Use of Gulf of Mexico sites (Plans A, B, E, and Modified Plan A) would have no significant impact on wildlife resources.

Disposal into the existing upland disposal sites would have similar impacts to the "No Action" alternative. Use of the Tennessee Gas Transmission Company disposal area in Plans C and E would impact wildlife species utilizing this scrub/shrub area. These species would include muskrat, nutria, clapper rail and numerous wading and songbird species.

The creation of the breakwater and marsh at Grande Batture (Plan D) would have a positive environmental effect on wildlife resources by reducing the erosion potential to the Point aux Chenes marsh. In addition this plan

Although the possibility exists that some mounding of materials may occur with this disposal option, the wave climate on the Gulf shore of the barrier islands is such that this should not pose significant impacts to the resources of Horn Island.

The use of open water disposal sites in Mississippi Sound in Plans A, C, D and Modified Plan A would temporarily disrupt the aquatic resources within the area similar to the "No Action" alternative. Benthic organisms not able to crawl through the dredged material layer would be smothered, however since the materials to be disposed of are similar in texture and organic content to sediments throughout this area of the sound, migration into the area would be rapid and depending upon time of disposal, repopulation by planktonic larvae would allow the area to return to predisposal conditions within 6 to 12 months (Maurer et al., 1974; Markey et al., 1975; McCauley et al., 1976).

Plan A and Modified Plan A would utilize a Gulf of Mexico disposal site for new work material from the sound channels; Plan B would utilize the site for both new work and maintenance materials from these channels; and Plan E would utilize the site for the new work from the Upper and Lower Pascagoula channels and maintenance materials from the sound channels. The site currently used for deposition of materials dredged from the entrance channel lies in an area approximately 2 miles south of the eastern end of Horn Island in 30 to 36 feet of water. Studies at this site indicate that no long-term or irreversible effects have occurred due to disposal operations (Harmon, 1983). This site is characterized as primarily coarse to fine grain sands. Since the material to be dredged from the sound channels consists primarily of silt and clay size particles it will be necessary to locate other sites with these substrate characteristics similar to the dredged material in order to meet the criteria for the evaluation of applications for ocean dumping of materials (40 CFR 227 & 228) and to apply to the Environmental Protection Agency for site designation. Possible sites are available south of the safety fairway, in depths of 40-60 feet, approximately 5-14 miles south of Horn Island. The Environmental Protection Agency, by letter dated March 5, 1985, has concurred with the assessment that suitable sites could be designated within this reasonable distance of the project. Use of this undesignated site would result in disruption of the benthos of an undetermined acreage of Gulf of Mexico bottoms. These communities should repopulate within 6 - 12 months of disposal and should attain predisposal characteristics after this time. The motile fishery resources utilizing this area would tend to avoid the area during the disposal operation and some members of this group would return soon after operations had ceased to scavenge upon food made available in the dredged material. After the benthos has repopulated the fishery resource should return to predisposal levels. Impacts resulting from Plans B and E would recur at 12-18 month intervals with the deposition of maintenance materials dredged from the sound channels. Aquatic mammals and reptiles would not be impacted by the proposed activity.



coverage but would repopulate within approximately 6 months. Motile aquatic resources such as shrimp, crabs and fish would tend to avoid the area where dredging and disposal operations were ongoing. Larval and young age class aquatic organisms may become entrained during the dredging and disposal process due to their inability to avoid the area of operation. The degree of these impacts would vary with location and temporal setting of the operations. Impacts would be expected to be most severe in spring/summer in the nearshore areas of Mississippi Sound. The impacts to the overall fishery of Mississippi Sound however, are unknown. No oyster resources would be impacted under this alternative.

The construction of the required mooring facilities for the LNG facility would have some impacts on the aquatic resources under the "No Action" alternative. The degree of these impacts is not specifically known, however, it is expected that they would be minor. The proposed SMA plan for the Pascagoula area does not allow for any extension of the current shoreline, therefore extensive filling of the wetlands or shallow water-bottoms south of the existing dike would not be expected. The required mooring facilities would probably be designed to use piling supported structures so as not to impact these resources or impact water quality in the upper Mississippi Sound area.

Deepening of the channels encompassed by the Pascagoula Harbor Project would remove all macrobenthos from the channel area. The channel bottoms, however, would repopulate within 6 to 12 months due to immigration of species from adjacent areas and larval settlement. Maintenance of the deepened channel would result in impacts similar to those of the "No Action" alternative. The deepened channels provide refuge for various fish and shellfish species during colder periods similar to the "No Action" alternative.

Widening of the Bayou Casotte channel and construction of the turning basin would result in the conversion of approximately 55 and 40 acres, respectively, of shallow bay bottoms to deeper channel bottoms under Plans A, B, C, D, and E. Modified Plan A would result in the conversion of 55 and 25 acres, respectively, with the widening and construction of the turning basin. These areas would repopulate through immigration of individuals from adjacent areas and larval settlement. The existing benthic community, characterized as a costal margin mud community would be converted to one containing species from the deeper open sound muddy-sand communities. Studies done in the Mississippi Sound and Adjacent Areas Study (USA COE, 1983) indicate that the deeper communities are very valuable feeding areas for demersal, bottom feeding fishes such as older age classes of sea catfish and southern kingfish. The shallow muddy habitat is also a very valuable food source for fishes, particularly the young age classes.

Use of the littoral zone south of Horn Island as a disposal area for entrance channel materials would have minor short duration impacts on aquatic resources. The aquatic organisms utilizing this area are adapted to wave induced sedimentation and littoral sediment transport and the disposal impacts should be similar to the natural sedimentary processes of the area.

5.1 Vegetation. Under the "No Action" alternative any vegetation growing within the existing diked disposal sites would be impacted during maintenance activities. It is possible that some revegetation could occur between these cycles. Similar impacts would occur with the implementation of Plan A, B, C, D, E, or Modified Plan A. Also under the "No Action" alternative the Tenneco site would have been converted to an Liquefied Natural Gas (LNG) facility with the subsequent loss of 200 acres of scrub/shrub habitat.

In addition, Plans C and D require an expansion of the existing Singing River Island disposal site. This expansion would encompass approximately 50 acres of wetlands on the southwest side of the island. This area is characterized by salt marsh hay, smooth cordgrass and black needlerush.

With the widening of Bayou Casotte, under Plans A, B, C, D, or E, a 19 acre site on the west side of the bayou, the southern tip of Greenwood Island, would be excavated for construction of the turning basin. Approximately 8-10 acres of this site is scrub/shrub wetland characterized by wax myrtle and marsh elder. The remaining acreage is emergent wetland characterized by black needlerush, common reed, and smooth cordgrass. Each of these alternatives would cause the same impacts associated with construction of the turning basin. Under Modified Plan A, the turning basin has been redesigned to have a 1,150-foot turning radius. This alternative would result in the loss of 4 acres of emergent wetland characterized by black needlerush, common reed, and smooth cordgrass on the southeast tip of Greenwood Island. At this time, no practical alternative exists for the loss of these wetlands. It is possible, however, that further refinements in the design of the turning basin may allow avoidance of this area. This will be investigated during the post authorization phase of the project.

Implementation of plans C and E would result in the disturbance of 257 acres of scrub/shrub vegetation including wax myrtle, marsh elder, sea myrtle, goldenrod, Cogongrass, torpedo grass, saltmarsh bulrush, smartweed and saltgrass located within the previously diked area on the Tennessee Gas Transmission Company property on the southeast side of Bayou Casotte. The tidally influenced marsh south of the old disposal site would not be impacted by the proposed discharge.

Plan D would result in the creation of 810 acres of estuarine wetlands which would be planted with smooth cordgrass, black needlerush, saltmarsh hay and other species common to the area. In addition, this plan would protect from erosion, the pristine Point aux Chenes marshes resulting in the preservation of this very valuable resource.

No sea grass beds would be impacted by implementation of any of the alternative plans.

5.2 Aquatic Resources. Under the "No Action" alternative, the macroinfaunal resources of the channel bottoms would continue to be disrupted on a 12- to 18-month basis. Those communities of the open water disposal sites would be affected to varying degrees depending on depth of

TABLE EIS-4 (con't)

Action and Alternatives	Comparative Impacts of Alternatives			
	<u>Horn Island</u>	<u>Mississippi Sound</u>	<u>Singing River</u>	<u>Tenneco</u>
No Action	N/A	4,200 acres of bottoms affected during disposal 1,400 acres of channel bottoms affected during dredging	333 acres of existing diked disposal area to be used	LNG facility on line 200 acres scrub/shrub wetland utilized
Plan A	Nourish island and retard erosion	6,000 acres of bottoms affected during disposal 1,400 acres of channel bottoms affected during dredging	333 acres of existing diked disposal area to be used	LNG facility on line
Plan B	Nourish island and retard erosion	1,400 acres of channel bottoms affected during dredging	333 acres of existing diked disposal area to be used	LNG facility on line
Plan C	Nourish island and retard erosion	1,400 acres of channel bottoms affected during dredging	333 acres of existing diked disposal area to be used 50 acres of wetlands to be diked and filled	LNG facility on line - site not available for use as disposal area
Plan D	Nourish island and retard erosion	6,000 acres of bottoms affected during disposal 1,400 acres of channel bottoms affected during dredging	333 acres of existing diked disposal area to be used 50 acres of wetlands to be diked and filled	LNG facility on line
Plan E	Nourish island and retard erosion	1,400 acres of bottoms bottoms affected during dredging	333 acres of existing diked disposal area to be used	LNG facility on line - site not available for use as disposal area
Modified Plan A	Nourish island and retard erosion	4,200 acres of bottoms affected during disposal 1,400 acres of channel bottom affected during dredging	333 acres of existing diked disposal area to be used	LNG facility on line

TABLE EIS-4

## Comparative Impacts of Alternatives

No Action and Alternatives	Comparative Impacts of Alternatives			Gulf
	Double Barrel	Grande Batture	Greenwood	
No Action	115 acres of existing diked disposal area to be used	N/A	101 acres of existing diked disposal area to be used	Maintenance of entrance channel to the Gulf
Plan A	115 acres of existing diked disposal area to be used	N/A	101 acres of existing diked disposal area to be used, 10 acres of scrub/shrub and 9 acres of emergent wetland to be dredged	New work to Gulf
Plan B	115 acres of existing diked disposal area to be used	N/A	101 acres of existing diked disposal area to be used, 10 acres of scrub/shrub and 9 acres of emergent wetland to be dredged	New work to Gulf Maintenance to Gulf
Plan C	115 acres of existing diked disposal area to be used	N/A	101 acres of existing diked disposal area to be used, 10 acres of scrub/shrub and 9 acres of emergent wetland to be dredged	N/A
Plan D	115 acres of existing diked disposal area to be used	801 acres of wetland to be created	101 acres of existing diked disposal area to be used, 10 acres of scrub/shrub and 9 acres of emergent wetland to be dredged	N/A
Plan E	115 acres of existing diked disposal area to be used	N/A	101 acres of existing diked disposal area to be used, 10 acres of scrub/shrub and 9 acres of emergent wetland to be dredged	New work to Gulf Maintenance to Gulf
Modified Plan A	115 acres of existing diked disposal area to be used	N/A	101 acres of existing diked disposal area to be used, 4 acres of emergent wetland to be dredged	New work to Gulf

small boat and marina facilities located in the East and West Pascagoula Rivers and Bayou Cumbest which handle the commercial fishery fleet and recreational vessels.

4.2.18 Public Facilities and Services. Mississippi Power and Light Company provides electricity to the study area from their steam plant on the Escatawpa River, north of Moss Point, which utilizes a closed-loop water pond.

The City of Moss Point has two wastewater treatment facilities, neither of which is adequate to meet the requirements of the permit conditions. The Dantzler Street facility discharges to the East Pascagoula River and the McFarland Street facility discharges to the Escatawpa River. The City of Pascagoula has three activated sludge wastewater treatment facilities, all of which are in poor condition and are not in compliance with permit limits. Two of these plants discharge into the Pascagoula River, the third into Bayou Chico, thence, to the Mississippi Sound (MBPC, 1982).

Construction is currently underway to expand the Frederick Street treatment plant in Pascagoula to a 10.6 MGD activated sludge plant with a discharge to the Pascagoula River. Target completion date is July, 1986, at which time all other existing treatment facilities in both Moss Point and Pascagoula will be phased out.

4.2.19 Cultural Resources. Eight historic properties within Jackson County (Louisville and Nashville Railroad Depot (Pascagoula); Louisville and Nashville Railroad Depot (Ocean Springs); Old Spanish Fort (Old French Fort), Pascagoula Central Fire Station No. 1, Alfred E. Lewis House, DeGroote Folk House, Griffin House, and the Front Street Historic District) are currently listed on the National Register of Historic Places. As of June 1983, there were 115 recorded archeological sites in Jackson County. None of these sites are currently listed on the National Register of Historic Places. However sites 22Ja516 ("Big Greenwood Island" site) and 22Ja618 ("Little Greenwood Island" site) have been determined to be eligible for inclusion in the National Register. Site 22Ja516 is a buried cultural deposit containing well preserved floral, faunal, and human remains and intact cultural features. These cultural deposits occur intact despite serious looting of the site by pothunters. Site 22Ja618 is a shell midden which remains relatively undisturbed despite some evidence of looting.

More than seventy sunken vessels have been recorded in the Pascagoula area however, very little information is available on their location, condition or significance. A survey of the channel alignment and seven possible disposal locations located seven clusters of magnetic anomalies and 10 individual anomalies that have been recommended for additional investigation (Mistovich et al., 1983).

5.0 Environmental Effects. The following paragraphs describe the effects of each detailed plan on the previously described significant resources. Table EIS-4 compares the impacts of each of the alternative plans on the proposed disposal areas.

Economic Analysis, 1982). In 1980, the racial mix in Jackson County was 80 percent white, 19 percent black, and 1 percent Asian and American Indian.

4.2.12 Economy. The economy of Jackson County is strongly dependent upon manufacturing activities, primarily the shipbuilding and retrofitting activities of Ingalls Shipbuilding Corporation, and port related activities. In 1978, manufacturing contributed 64 percent of the total earnings of the county followed by government and services at 9 and 7 percent respectively. Per capita income (in 1972 \$) was \$4,121 and is expected to increase to \$18,093 in 2040 with a total labor force of 87,103 (US Dept Commerce, Bureau Economic Analysis, 1982).

4.2.13 Community Cohesion. Two very generalized types of cohesion are exhibited by the citizens of coastal Jackson County. The first is a traditional type, based on long and cherished friendships, kinship ties, religious ties and a sense of community developed out of many years of close interaction and interdependence. The second is a more formalized economic type of cohesion. Residents indicate that the most important factors influencing resident location were closeness to friends, cost of housing, closeness to work and church, and a good neighborhood.

4.2.14 Recreational Opportunities. The Mississippi Coast offers a diversity of recreational and cultural opportunities including boating, water skiing, fishing, beach activities, hunting, and camping. The Gulf Island National Seashore is a National Park which includes Horn and Petit Bois Islands in Mississippi.

4.2.15 Noise. Noise problems are those associated with day-to-day activities, such as traffic, construction, and industry. Noise levels are higher in the vicinity of Bayou Casotte and East Pascagoula River and industrial areas.

4.2.16 Aesthetics. The aesthetic quality of the area ranges from excellent in the region of the barrier islands and Mississippi Sound to poor in the industrialized areas. Much of the rest of the study area is variable in nature with well-kept residential neighborhoods to less aesthetically pleasing commercial areas.

4.2.17 Transportation. The Pascagoula area has a well-developed primary and secondary road system of approximately 1,300 miles including Interstate Highway 10 and US Highway 90, running east to west. Several major rail carriers serve the area including the Family Lines System (Louisville and Nashville), the Illinois Central Gulf, the Norfolk Southern, and the Burlington Northern. Jackson County has one general aviation terminal and Pascagoula is equidistant from the commercial air terminals at Mobile and Gulfport and approximately 100 miles from the New Orleans Airport.

The Port of Pascagoula is the largest in Mississippi and in 1981 handled over 26,000,000 tons of cargo. The port handles deep-draft, ocean-going traffic primarily grain and petroleum products. In addition, there are

The following paragraphs summarize: (1) measures which have been incorporated into the design of the project to enhance the environment or to minimize impacts; (2) measures which have been incorporated into the design which mitigate for unavoidable impacts; and (3) measures recommended by the US Fish and Wildlife Service to mitigate for project impacts to fish and wildlife resources.

6.1 As a result of the terrestrial survey by Mistovich et al., 1983, two sites, 22Ja516 ("Big Greenwood Island Site") and 22Ja618 ("Little Greenwood Island Site") were evaluated to be eligible to the National Register of Historic Places. Although they have been partially disturbed by pothunting, both contain areas which remain undisturbed.

The mitigation of these sites will be undertaken using primarily hand excavation methods and block technique excavation. Part of the historic component of Site 22Ja516 is a military cemetery and a determination of its significance will be made.

6.2 The disposal of sandy materials dredged from the Entrance channel in the littoral zone south of Horn Island is designed to offset the effects of the location of the navigation channel on the natural littoral drift system of the northeast Gulf of Mexico coastline. Under normal conditions the littoral system transports sandy materials in an east to west direction along the Gulf shoreface of the barrier islands. The establishment of the entrance channel in the barrier island pass near the western end of Petit Bois Island has interrupted this transport system. In addition, due to the westward migration cycle of the barrier islands the western end of Petit Bois impinges on the channel and is dredged during each maintenance cycle. Under the "No Action" alternative materials would be disposed in a site in the Gulf approximately two miles from Horn Island in depths of 32 feet or greater. This effectively removes the sand from the littoral system. In addition materials dredged from the impoundment basin are disposed in an area adjacent to the western side of the channel as shown on Plate I of the Main Report. Some of this material does get into the littoral system, however, a large majority of it is transported into Mississippi Sound and along the northern shore of Horn Island and also back into the navigation channel. It is also possible that some of this material may be transported into the area of submersed vegetation north of Horn Island. If this occurred, there could be possible negative impacts to this valuable resource.

Results from the Waterways Implicit Flooding Model (WIFMS) which was modified during the Mississippi Sound and Adjacent Areas Study (USACE, 1983) indicated that if materials were placed in an area in shallow water south-southeast of Horn Island that the currents were of sufficient velocity to cause the material to move in a westerly direction. This would allow the sandy materials to get caught in the littoral drift system and should help to alleviate the erosional trends on Horn Island.

During the public hearing on the proposed navigation improvements at Pascagoula and in subsequent letters of comment on the DEIS, personnel of the Gulf Coast Research Laboratory requested that we restudy the location of the proposed disposal site south of Horn Island. As stated in our response to their comment, paragraph 8.5 of the FEIS, we will perform additional studies on this issue during the Continuing Planning and Engineering (CP&E) phase. In addition, due to our commitment to the productive use of dredged materials, we will restudy the possibility of transporting materials to the eastern end of Petit Bois Island in an effort to maintain the island shoreline. We will also study the possibility of the nourishment of Round Island, which is located in Mississippi Sound, with new work material to be dredged from the Upper and Lower Pascagoula Channels.

6.3 Researchers at the Gulf Coast Research Laboratory in Ocean Springs, Mississippi have concluded that dredging operations in the lower Bayou Casotte have improved the area by removing sediments containing contaminants or by burial of surficial sediments, which have been shown to contain the majority of the contaminants, with dredged materials (Lytle and Lytle, 1983). Evidence indicated that most of the contaminants within the Pascagoula Harbor-Bayou Casotte sediments are located in the upper 10-25 cm and are tightly bound to the sediments. Dredging of the channels and placement of the material in the existing upland sites at Greenwood, Double Barrel, and Singing River Island or the proposed site on the Tennessee Gas Distribution Company property would effectively remove these contaminants from the estuarine system. Disposing of the materials in the proposed Grande Batture site or in open water would cover the contaminated sediments with clean sediments in a manner similar to that used successfully in the New York Bight (Reid et al., 1982) and New York Harbor (Bokuniewicz, 1982).

6.4 Cessation of the practice of open water disposal in Mississippi Sound, particularly the use of disposal sites 1, 2, 4, 5, and 6N(6A), would reduce the possibility of worsening water quality conditions within this portion of the Sound. Results of the WIFMS numerical model indicated that a possibility existed that flushing in this area could be reduced if these disposal areas were to shallow to the minus 4-foot elevation permitted by the State. Since these areas were deleted in late 1984 from use in the existing project, we do not believe any more positive impacts could be gained from the further cessation of open water disposal. Historical bathymetric data do not support any shallowing trends for the disposal areas within the lower sound (6S (6B), 7, 8, and 9) and comparison of "preproject" and existing condition runs of the WIFMS model indicate that no significant changes in circulation or salinity gradients have been induced by the open water disposal method used with the existing Federal project.

6.5 The reconstruction of the Grande Batture Island chain (Alternative Plan D) utilizing dredged material and riprap would have significant positive impacts on the environment of coastal Mississippi and Alabama. This area represents an abandoned subaerial delta of the Escatawpa River which has undergone steady erosion. Point aux Chenes, Grand and Portersville Bays, between the Point aux Chene, South Rigolets and Point aux Pins headlands



appear to be marginal bays on the flanks of small relic subdeltas. Erosional shore retreat reduced the subdeltas to marshy headlands with sand spits extending in both directions. Segmentation of the spits resulted in the five mile long Grande Batture island chain and in the Isle of Dames chain east of Point aux Pins. Erosion eliminated both island chains by the 1960's - 1970's (Otvos, 1982).

The erosion of the Grande Batture Islands has resulted in increased wave energy to the shoreline of Point aux Chenes and increased salinities in the bay itself. These factors have caused erosion of the coastal marshes and destruction of the oyster resources of the area. Studies indicate that shoreline erosion in the area results in the loss of approximately 10 acres of saline marshes per year. These wetlands, composed primarily of smooth cordgrass and black needlerush, are extremely important to the ecological functioning of Point aux Chenes Bay, Mississippi Sound and the nearshore Gulf of Mexico.

Although of significant long term positive impacts to the environment, Alternative D was not selected due primarily to increased costs over all other alternatives considered. In response to comments from the State of Mississippi and the Gulf Coast Research Laboratory we will perform additional studies on reconstructing Grande Batture during CP&E (see paragraph 8.5 of the FEIS).

6.6 The recommended plan would result in the unavoidable loss of approximately four acres of emergent wetlands, located at the southeast tip of Greenwood Island, during the construction of the Bayou Casotte turning basin. To achieve the project purpose, no practicable dredging alternative exists at this time than to affect these wetlands. Although, the number of acres to be impacted is small, the loss to the Bayou Casotte system would be significant. Commercial and recreational fishing is an important aspect of the economy of Pascagoula and coastal Mississippi. Greater than 85% of all Mississippi landings are received through the ports of Pascagoula and Moss Point. The majority of the species landed spend part of their life cycle within the estuary. Emergent wetlands, such as those to be dredged, form the basis of the food chain for these estuarine dependent species. In the past, the majority of the emergent wetlands between the Pascagoula River and Bayou Casotte have been filled for industrial, commercial, or residential development. Future development of the area, as projected in the Special Management Plan (SMA) for Pascagoula would result in the filling and/or dredging of the remaining wetlands in the vicinity of Greenwood Island. Although these developments would be mitigated, the proposed mitigation areas are not in the immediate vicinity of the impacts. In order to mitigate for the loss of this habitat, it is proposed that six acres of disturbed wetland habitat located south of the Greenwood Island disposal site be restored to its previous natural emergent nature (see Figure 7 on the Main Report). The impacts to this area, associated with the use of the Greenwood Island disposal area, have resulted in increased elevations in portions of the wetland and impoundment of other areas. By shaving down and

removing high areas, daily tidal inundation would be restored and the area would begin to function as a productive wetland.

The four acres to be lost through dredging is functioning as an emergent wetland and although it is located in a highly industrialized area its value to the Mississippi Sound ecosystem is high. A Habitat Evaluation Procedure (HEP) analysis was used to determine the impact to the ecosystem with the implementation of the recommended plan. The HEP is an analytical methodology that is based upon a determination of the overall value (Habitat Suitability Index - HSI) of affected habitats to selected species. This evaluation was a joint effort between the U. S. Fish and Wildlife Service and the Corps of Engineers and in this case four species were used including: spotted seatrout (Cynoscion nebulosus), brown shrimp (Penaeus aztecus), Clapper Rail (Rallus longirostris), and muskrat (Ondatra zibethicus). The HSI for each species is multiplied by the available acreage to obtain the number of habitat units in the area. The habitat units are annualized for the with and without project conditions and then compared to determine the overall gains or losses attributable to the project. With the recommended plan, the loss of four acres of emergent wetlands in the Bayou Casotte would result in a loss of 4.0 AAHUs for shrimp and 3.0 AAHUs for seatrout. Fishery impacts are reflected in the lower HSI values over the project life for seatrout (HSI .49) and shrimp (HSI .29) and are a result of the reduction of marsh to open water percentages. Assuming a HSI value of 1.0 could be reached over a 5 year period in a created wetland, 6 acres of wetlands must be created to replace both the shrimp and seatrout values. The restoration of scrub/shrub habitat to emergent wetland would result in increases in the HSI value of shrimp and seatrout over the project area due to the increase of marsh to water ratio. The loss of the 4 acres would result in a loss of 3 AAHUs for rail and 2 AAHUs for muskrat and the HSI values for rail and muskrat for the mitigation area are .58 and .40, respectively. Again, assuming a HSI value of 1.0 could be reached over a 5 year period 4 acres of wetland would be required to replace the wildlife values. Since fisheries impacts require 6 acres of the same habitat, both fish and wildlife resources would be mitigated by the creation of 6 acres of emergent wetland.

Our mitigation goal for the provision of navigation improvements at Pascagoula Harbor is for no habitat value losses to occur to the Mississippi Sound ecosystem. For this reason, we propose to shave down approximately six acres of scrub/shrub wetland, including a berm south of the wetland area, and plant the area with appropriate emergent vegetation species. These actions will restore daily tidal inundation to the six acres and provide conditions conducive to natural functioning of emergent wetlands. The proposed mitigation area is owned in fee by Jackson County who will provide these lands for the economic life of the project. The materials would be removed by dragline and placed within the Greenwood Island disposal area. The area would then be revegetated with Spartina alterniflora and Juncus roemerianus. The need for subsequent maintenance of the area would not be expected; however, periodic monitoring of the area would be incorporated in the final mitigation plan and coordinated with the concerned

State and Federal agencies. In the proposed Special Management Area (SMA) plan for the Pascagoula, this area is designated for Preservation/Enhancement; therefore, it would not be subject to development pressures in the foreseeable future.

Preliminary coordination with the State of Mississippi, Bureau of Marine Resources and the U. S. Fish and Wildlife Service indicate that this mitigation effort would be appropriate to mitigate for the loss of the four acres of emergent wetland in Bayou Casotte. Further coordination efforts will be made during the Continuing Planning and Engineering phase of the proposed project.

6.7 Under the provisions of the Fish and Wildlife Coordination Act, the Fish and Wildlife Service evaluated the impacts of each of the alternative plans to the fish and wildlife resources of the area. Their evaluation and recommendations for mitigation are included in The Fish and Wildlife Coordination Act Report dated September 1984 and appended as Appendix D to the Main Report. A discussion of their recommendations is contained in the Public Views section of the Main Report and as a preface to the Coordination Act Report.

In the Final Fish and Wildlife Coordination Act Report, the Fish and Wildlife Service (FWS) recommended that 7 acres of emergent wetland be created by shaving down low productive uplands to mitigate for dredging the Bayou Casotte turning basin. These recommendations were based on Habitat Evaluation Procedure (HEP) analyses. At the time their report was prepared the design of the turning basin would have impacted approximately 18 acres on Greenwood Island including 10 acres of emergent wetland. Subsequently the turning basin was redesigned due to changes in the design vessel such that a total of only 8 acres of land on Greenwood Island would be dredged. The COE has designed a plan which would mitigate for these losses by providing emergent wetlands at other sites on Greenwood Island. This plan has been discussed in paragraph 6.6 above.

#### 7.0 List of Preparers

<u>Name</u>	<u>Expertise</u>	<u>Experience</u>	<u>Role in FEIS Preparation</u>
Mr. W. W. Burdin (Study Manager)	Engineering/ Coastal	10 years, Hydraulic Design; 15 years, Coastal Planning, Mobile District	Study Manager, Formulation of Alternative Plans
Mr. R. D. Barrineau	Engineering/ Environmental	15 years, EIS Studies, Mobile District	Effects on Water Quality

Mr. C. M. Flakes	Environmental Laws and Regulations	4 years, Environmental Compliance, Mobile District	Environmental Compliance Manager
Ms. D. H. Gibbens	Archeology	5 years, Cultural Resource Management, Mobile District	Effects on Cultural Resources
Mr. M. James	Engineering/ Hydraulic	4 years, Hydraulic Research, Waterways Experiment Station; 7 years, Numerical Modeling/ Sedimentation Studies, Mobile District	Numerical Modeling
Dr. S. Ivester Rees	Oceanography	6 years, Assistant Professor, University of Alabama; 4 years, EIS Studies Mobile District	FEIS Coordinator

#### 8.0 Public Involvement.

8.1 Public Involvement Program. A history of public involvement is discussed in the Main Report and in Appendix E to the Main Report.

8.2 Required Coordination. Coordination for this study began in 1967. Principal Federal agencies with which coordination was conducted include the Fish and Wildlife Service, National Marine Fisheries Service, Gulf Islands National Seashore (National Park Service) and Environmental Protection Agency. At the State level, coordination was through the Mississippi Department of Wildlife Conservation, Bureau of Marine Resources, Mississippi Bureau of Pollution Control, and Gulf Coast Research Laboratory. At the local level, coordination was with the Jackson County Port Authority and Jackson County Board of Supervisors.

8.3 Statement Recipients. The Draft Survey Report and Draft Environmental Impact Statement was mailed to Federal and State Agencies and other parties on July 18, 1984. Comments were requested from the following:

Governor William Allain  
 Senator John C. Stennis  
 Senator Thad Cochran  
 Representative Trent Lott

## Government Agencies

Advisory Council on Historic Preservation  
Agriculture Stabilization and Conservation Service  
Department of Agriculture  
Soil Conservation Service  
Department of Commerce  
    National Marine Fisheries Service  
Department of Energy  
Environmental Protection Agency  
Federal Emergency Management Administration  
Federal Maritime Commission  
Department of Health and Human Services  
Department of Housing and Urban Development  
Department of the Interior  
    US Fish and Wildlife Service  
    National Park Service, Gulf Islands National Seashore  
Department of Transportation  
U.S. Coast Guard  
Federal Highway Administration  
Federal Aviation Administration  
Federal Railroad Administration

Mississippi Department of Natural Resources  
Mississippi Department of Wildlife Conservation  
Mississippi Department of Archives and History  
State Conservation Service  
Southern Mississippi Planning and Development District  
Gulf Regional Planning Commission  
Jackson County Port Authority  
Jackson County Board of Supervisors  
Gulf Coast Research Laboratory

## Public Interests

8.4 The major comments received on the DEIS are concerned with the following topics:

The jurisdictional nature and description of the Tenneco site.

The need for additional mitigation for the use of the Tenneco site.

Requests for re-evaluation of the location of the Horn Island disposal site.

Re-evaluation of the Grande Batture nourishment element.

Evaluation of the nourishment of Round Island with materials dredged from the Upper Pascagoula channel.

All comments have been appropriately responded to and necessary changes have been made to the text of the EIS as specifically indicated in the Public Views and Responses Section (paragraph 8.5).

8.5 Public Views and Responses. A total of nine letters of comment were received concerning the DEIS. Copies of these letters follow. Comments were received from the following:

	<u>FEIS Page Number of Letter</u>
US Environmental Protection Agency	EIS-44
US Department of the Interior	
a. Regional Environmental Officer	EIS-47
b. Endangered Species Field Office	EIS-60
US Department of Commerce	
National Oceanic and Atmospheric Administration	EIS-62
State of Mississippi, Office of the Governor,	
State Clearinghouse for Federal Programs	EIS-65
Mississippi Department of Wildlife Conservation	
Bureau of Marine Resources	EIS-67
Mississippi Department of Natural Resources	
Bureau of Pollution Control	EIS-70
Gulf Coast Research Laboratory	EIS-73
Obstetrics, Gynecology, Infertility Associates; P.A.	EIS-76



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET  
ATLANTA, GEORGIA 30365

SEP 04 1984

4PM-EA/GM

Colonel Patrick J. Kelly  
District Engineer  
U.S. Army Corps of Engineers, Mobile  
P.O. Box 2288  
Mobile, Alabama 36628

Dear Colonel Kelly:

We have reviewed the Draft Environmental Impact Statement (EIS) for the Pascagoula Harbor Improvement of the Federal Deep-Draft Navigation Channel in Jackson County, Mississippi, and have some objections to the document's tentatively selected alternative. Specifically, we view the election to place spoil material from the initial construction at Bayou Cassotte into a 257 acre tract of wetlands (the "Tenneco Site") as inconsistent with this agency's current wetland regulatory practices. Our environmental concerns regarding this option and the associated issue of wetland jurisdiction have been detailed to you by members of my staff during previous coordination meetings on the Pascagoula Special Management Area (SMA) and Howard Zeller's letter of August 3, 1984. Since our reservations closely parallel those enumerated in the recent Fish and Wildlife Coordination Act Report Supplement (July 16, 1984) on this facility (see attached), we are not repeating them here.

There is one area in which EPA diverges from the conclusions offered in the Fish and Wildlife Service's document. Namely, we do not view a wetland loss of this magnitude as having any practicable solution short of creation, restoration, or enhancement type mitigation. Specific sites for these activities could be coordinated with the SMA Task Force since they have already discussed most of the mitigation alternatives that are available. We realize opportunities for this type of mitigation can be expensive and/or difficult to execute. Further, we are sensitive to the overall economic and societal merits of the project and the need for its timely processing. However, we believe to be consistent with SMA planning to date, any wetland areas filled should be mitigated as discussed above.

From our perspective, the issue could also be resolved by depositing all the subject material (both initial construction and maintenance) in an approved site in the Gulf of Mexico. With this design modification the project could move forward expeditiously. We urge you to consider changing the selected plan in the Final EIS to reflect this disposal option.

4 On the basis of information contained in the EIS there appears to be some noteworthy reasons for upgrading the existing Pascagoula harbor facilities despite our objection to the use of 257 acres of wetlands as a dredge disposal site. Therefore, we have assigned the document a rating of ER-2. That is, there are some important outstanding environmental problems associated with the present proposal, but we believe that they can be resolved through additional consultation. If you wish to discuss this matter in greater detail, Mr. Reginald Rogers and/or Ms. Beverly Ethridge (FTS 257-7901) of my staff will serve as our point of contact.

Sincerely yours,



E.T. Heinen, Chief  
Environmental Assessment Branch  
Office of Policy & Management



ponse to U.S. Environmental Protection Agency

Comment noted. No response necessary.

Comment noted. As of this date, the Special Management Area (SMA) Plan provides that the development of the Tenneco site would be reviewed under the normal permitting process. Recent additional coordination with the Tennessee Gas Transmission Company regarding their conceptual plans for the development of the Tenneco site has indicated that conflicts between the scheduling of their development activities and our construction timetable render Plan E non-implementable. Questions concerning the consistency of this plan with the SMA or Coastal Management Program are no longer relevant to the proposed action.

Throughout the planning process, steps have been taken to avoid or minimize adverse environmental effects as reflected in Sections 3.1 and 6.0 of the FEIS. The plan that maximizes net economic benefits while providing for minimized adverse environmental impacts is designated the NED plan and according to Corps regulations, this becomes the selected plan unless there are overriding circumstances that justify another less economical plan.

Comment noted. Since Plan E has been determined to be non-implementable, the unresolved issues concerning the use of the Tenneco site are no longer relevant. Appropriate changes have been made in the FEIS.



# United States Department of the Interior

## OFFICE OF ENVIRONMENTAL PROJECT REVIEW

Southeast Region, Suite 1360  
Richard B. Russell Federal Building  
75 Spring Street, S.W. / Atlanta, Ga. 30303  
Telephone 404/221-4524 - FTS: 242-4524

SEP 6 1984

ER 84/977

Colonel Patrick J. Kelly  
District Engineer  
U.S. Army Corps of Engineers  
Post Office Box 2288  
Mobile, AL 36628

Dear Colonel Kelly:

We have reviewed the Draft Environmental Impact Statement (DEIS) and draft Feasibility Report for the Pascagoula Harbor Project Jackson, Mississippi, and have the following comments.

### General Comments

#### The Fish and Wildlife Resources

1 The DEIS adequately describes the fish and wildlife resources within most of the project area. However, some discrepancies exist relative to the Tenneco tract as discussed below. The DEIS also clearly exposes many of the area's past and present environmental problems. However, the Fish and Wildlife Service (FWS) has several major concerns with this document which are: 1) we do not believe the impacts of the Corps National Economic Development (NED) Plan E have been adequately addressed; 2) there is no mitigation proposed for filling 257 acres of wetlands; and 3) the least damaging plan (B), which has a Benefit/Cost (B/C) ratio approaching that of the NED Plan E, was not selected.

2 The Corps NED Plan E requires the filling of about 257 acres of wetland habitat within the Tennessee Gas Transmission Company (Tenneco) area. This site is described on page 3 of the DEIS as being an upland. However, the Corps regulatory functions branch maintains that it is a non-jurisdictional wetland. Our field reviews, as well as those of other agencies, reveal that most, if not all of the area is a functional wetland. Much of the jurisdictional argument is based on the fact that the area has been previously used as a disposal area. While this is true, the area has reverted and now consists of tracts of emergent vegetation such as Scirpus robustus, Spartina patens, and Juncus roemerianus. Shrub species common to wetland areas include Eaccharius hamillifolia and Iva futescens. A remnant dike along the south side of this wetland is breached. As a result of the breach and the low height of the old dike, waters from the Gulf of Mexico can enter and exit the area during high tides such as those produced by storms.

The Tenneco site is providing both fish and wildlife benefits. Waterfowl, wading birds, raptors, songbirds, swamp rabbit, raccoon, nutria, reptiles and amphibians utilize this area. This wetland also provides detrital material to the adjacent estuarine system. Its overall values are further emphasized by EPA's recent concern over the Corps decision to not assert jurisdiction over this area. This matter is now being investigated by Environmental Protection Agency (EPA) and a final decision regarding jurisdiction is expected in the near future.

The FWS has addressed the impacts and mitigation of each plan in the Draft Fish and Wildlife Coordination Act Report dated June 1984. While the DEIS does reference our mitigation report, it does not specifically address the mitigation for each of the alternatives as recommended.

A major dispute involves the FWS' recommended Plan B and the Corps NED Plan E. The Fish and Wildlife Coordination Act Report recommended that Plan B be the selected plan. Plan B was recommended because it did not require filling wetlands, provided for deep gulf disposal of both new work and maintenance material, would improve circulation in the sound and require only a minor amount of mitigation. The Corps recommended Plan E would require filling 257 acres of wetlands that are currently providing valuable fish and wildlife functions. The FWS cannot support such a plan when Plan B is feasible, can meet project objectives with similar expenditures, and is significantly less environmentally damaging.

The Corps NED Plan E has a B/C ratio of 6.7 (without considering mitigation costs); our recommended plan (B) has a B/C ratio of 6.4 (no mitigation cost). Even without the consideration of environmental impacts and mitigation costs, these ratios are not significantly different. In fact, the only thing separating them is that it costs less to fill 200 acres of wetland than it does to take the dredged material to deep gulf sites. If the cost of mitigating this 257 acre wetland loss had been included in the B/C ratio, the B/C ratios would be much closer than the reported 6.7 and 6.4. The price of mitigation and the value of environmental quality should be weighed in developing a final plan.

Since other alternatives to wetland filling are obviously feasible, we do not believe that proposed plan complies with EPA's 404(b)(1) guidelines or Executive Order 11990 (Protection of Wetlands). In addition, due to the inadequate mitigation we do not believe the project has been planned within the full spirit and intent of the National Environmental Policy Act.

## Mineral Resources

- 8 Mineral producing facilities in Jackson County yield magnesium compounds, lime, and sulfur, but no minerals are produced within the project area. Our records do indicate, however, that natural gas and crude oil pipelines may be located near proposed disposal sites--I, J, H, G, E, F, CC, and AA (plate II). Depending on their proximity to the project area, adequate safeguards should be taken to protect the pipelines.

## Specific Comments

- 9 Page 3, Paragraph 1.1 - The FWS believes that the filling of about 257 acres of wetland would have a significant adverse impact on the environment. In view of the wetland vegetation present and the interaction of the area with the estuarine system, we do not believe that the Tenneco area should be identified as an upland disposal area.

- 10 Page 3, Paragraph 1.2 - Areas of controversy exist over the jurisdictional status of the Tenneco tract as well as the fact that there is no discussion of mitigating this loss should the filling of this area become unavoidable.

- 11 Page 3, Paragraph 1.3 - Obvious significant unresolved issues are apparent as indicated in the above comments as well as those in the general discussion section.

- 12 Page 4, Table 1 - We do not believe that Plan E complies with Executive Order 11990 in that 257 acres of wetlands would be filled when another feasible alternative (Plan B) of similar cost would avoid wetland destruction.

- 13 Page 12, Paragraph 3.2.5 - The 257 acres of scrub/shrub habitat should be clarified. This is a scrub/shrub wetland interspersed with various emergent vegetative species.

- 14 Page 13, Paragraph 3.2.7 - Again the description of the 257 acres of the Tenneco site should be stated as above.

- 15 In the past, several dredging activities within the Pascagoula area have occurred that have extensively damaged wetlands. Most involved cases of overpumping and dike failures. Therefore, this section should further discuss the direction of the effluent coming out of the disposal site and plans to monitor such operations. This would also apply to Plan C.

As with the other two, the use of the word "discovery" is not meant to be used to diminish the importance of the work, but to indicate that the work would not have been possible without the assistance of the Government.

[illegible]

It provides the opportunity to provide the service to

Sincerely yours,

Richard J. Hougland  
Chief, Environmental Assessment Branch



**UNITED STATES DEPARTMENT OF COMMERCE**  
**National Oceanic and Atmospheric Administration**  
NATIONAL MARINE FISHERIES SERVICE  
Southeast Region  
9450 Koger Boulevard  
St. Petersburg, FL 33702

August 31, 1984

F/SER11/EK  
813-893-3503

Colonel Patrick J. Kelly  
District Engineer, Mobile District  
Department of the Army, Corps of Engineers  
P.O. Box 2288  
Mobile, AL 36628

Dear Colonel Kelly:

The National Marine Fisheries Service (NMFS) has received the Draft Environmental Impact Statement (DEIS) Improvement of the Federal Deep-Draft Navigation Channel, Pascagoula Harbor, Mississippi. We have reviewed the DEIS and offer the following comments for your consideration.

General Comments

The EIS should contain the results of the Section 7 Consultation between the NMFS and the Corps of Engineers on the subject project. We reference our letter of May 29, 1984, providing a list of endangered and threatened species under NMFS purview that may be found in the project area and the NMFS letter of June 25, 1984, concluding the consultation process. These letters should also be added to Appendix E of the Technical Appendices.

In general, the document adequately addresses the alternative plans for deepening and widening the existing channels. The document also addresses the Special Management Area planning process currently underway for the Port of Pascagoula and discusses the results of the Mississippi Sound study. However, the rationale used to choose the selected plan is flawed.

Specific Comments

Rationale for Final Plan Selection, Page 59 and page EIS-13, 3.2.7 Plan E.

The Environmental Protection Agency (EPA) has initiated the process by which they will determine whether or not the Tenneco site disposal area is a wetland. The Corps of Engineers determination that the 257 acre proposed disposal site is not a wetland is contrary to the opinions of the EPA, the U.S. Fish and Wildlife Service (FWS), and the NMFS. The Mobile District has received letters from all three agencies regarding the wetland status of the proposed Tenneco disposal site. We concur with the FWS supplemental report in Volume II of the DEIS regarding the wetland nature of the site. The economic advantage of the selected plan is predicated on the 257 acres being "no longer" a wetland which eliminates the problems inherent in depositing material in that area.



Response to U.S. Department of Interior, Endangered Species Field Office

Comment noted. No response necessary.



# United States Department of the Interior

FISH AND WILDLIFE SERVICE

JACKSON MALL OFFICE CENTER

300 WOODROW WILSON AVENUE, SUITE 3185

JACKSON, MISSISSIPPI 39213

August 15, 1984

IN REPLY REFER TO:  
Log No. 4-3-84-595

Mr. Willis E. Ruland  
Department of the Army  
Mobile District, Corps of Engineers  
Post Office Box 2288  
Mobile, Alabama 36628

Dear Mr. Ruland:

This responds to your July 18, 1984 Draft Environmental Impact Statement for navigational improvements within Pascagoula Harbor, Mississippi. We have reviewed the information you enclosed relative to the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.).

I concur with your determination that the proposed project will not adversely affect listed species.

This does not constitute a Biological Opinion, as described under Section 7 of the Endangered Species Act. However, it does fulfill the requirements of the Act; no further endangered species coordination will be required for this project, as currently planned. If modifications are made to the project, or if additional information emerges concerning potential project impacts to listed species, further coordination with our office is requested.

If you require further information from our office regarding this project, please contact our office, telephone 601/960-4900.

I appreciate your participation in the efforts to enhance the existence of endangered species.

Sincerely yours,

Dennis B. Jordan  
Field Supervisor  
Endangered Species Field Office

cc: Department of Wildlife Conservation, Jackson, MS  
ES, FWS, Daphne, AL



23. Comment noted, however, additional coordination with the Tennessee Gas Transmission Company indicates that the Tenneco site would be unavailable for use as a disposal area therefore the issue raised in this comment is no longer relevant.

Utilizing this information, the Corps position that alternative plan D would have a significant positive impact on the coastal environment of Mississippi was based on the following:

1. shallow waters within the area are probably not a limiting factor to the fishery resources,
2. emergent wetlands, on the other hand, are probably more limiting both due to their lesser numbers and to their susceptibility to natural and manmade perturbations, and
3. the area of the bay to be filled was, in the recent past, fast land.

This alternative was not recommended due primarily to increased cost compared to all other alternatives considered in detail. In response to requests from the Mississippi Bureau of Marine Resources and the Gulf Coast Research Laboratory we will evaluate additional iterations of this alternative in the Continuing Planning and Engineering phase of the study.

21. Although the Tenneco site is classified as a scrub/shrub wetland and contains a number of vegetative species characteristic of wetland areas, the value of the site as put forth by the FWS is debatable. The site is a diked, previously used disposal area which prior to its use was a functional and productive wetland. Currently the area does not serve as a nursery or feeding area for fish or shellfish; it does not provide detrital export to the Mississippi Sound estuary, except under extreme climatologic or oceanographic conditions; it does not serve as a filter for water borne pollutants; nor does it act as a buffer in reducing wave related energy. The area does, however, provide habitat for wildlife species such as rabbits, racoons, nutria, and songbirds. Even so, the value to these species is debatable. The site is located within a highly industrialized area and the associated activities probably serve to reduce the use of the area by these species. In addition, furbearing mammals appear to favor areas within an intricate network of channels over large expanses of vegetation (Odum, W.E., and T.J. Smith. 1981. Habitat value of coastal wetlands. IN: Markovits, P.S. (ed). Proceeding US Fish and Wildlife Service Workshop on Coastal Ecosystems of the Southeastern United States). This area does not have a network of channels and during some months of the year may contain no standing water.

The DEIS included a discussion of the impacts that would occur to the wildlife resources with the use of the Tenneco site and it was the Corps position that the positive aspects of other elements of this alternative would have outweighed the impacts to the Tenneco site.

22. Comment noted.

18. A discussion has been added to paragraph 5.2 of the FEIS to include the impacts of time of dredging on the fishery resources of the area.
19. Paragraph 5.3 briefly summarizes the impacts of each of the alternative plans to the wildlife resources of the area and compares these impacts to those which would occur under the "No Action" alternative. This summary covers all the impacts discussed in the draft FWCAR. A discussion of mitigation in Section 5.0 is not required as discussed in comment 17 above.
20. Dr. Ervin Otvos of the Gulf Coast Research Laboratory, Ocean Springs, MS, has indicated that the Grande Batture Islands underwent substantial erosion during the late 1960's-1970's and today only a small islet at the western end remains. Alternative Plan D was designed so that the reconstruction would mimic the original shoreline of the island with deposition occurring within the existing 3-foot depth contour (Plate VII of the Main Report). This area covers approximately 810 acres.

The Mississippi Sound encompasses approximately 500,379 acres of water surface at mean high water (MHW) of which 30% is less than 6 feet in depth; 64% is less than 12 feet in depth and 81% is less than 15 feet in depth. Within the Pascagoula Harbor study area, there are approximately 131,233 acres of water surface at MHW of which 44,930 acres or 34% is less than 3 feet in depth and 43 % (56,218 acres) is less than 6 feet in depth (Christmas, J.Y. 1973. Area Description. IN: Christmas, J.Y. (ed). Cooperative Gulf of Mexico Estuarine Inventory and Study, Mississippi. Phase I. Gulf Coast Research Laboratory, Ocean Springs, MS.).

The 810 acres to be filled represents approximately 2% of the shallow bottoms less than 3 feet in depth and approximately 1.5% of those bottoms less than 6 feet in depth within the Pascagoula Harbor study area. The FWS considers waters less than 6 feet deep to be shallow productive waters. In contrast, the 810 acres of habitat to be created represents greater than 3% of the total existing wetlands of the Pascagoula Harbor study area.

Within the more restricted area of Grande Batture and the Point aux Chenes marsh, the 810 acres represents 10% of the open water area (actual acreage of bottoms less than 6 feet deep not available, however, the navigation chart including this area, NO 11373, indicates depths of 5 feet or less) and 36% of the existing emergent wetlands. In addition, it has been estimated that approximately 200 acres of emergent wetlands have been lost due to erosion in the area between 1956 and 1979 (figures compiled by the FWS National Coastal Ecosystem Team, Slidell, LA). This provides an annual erosion loss rate of approximately 8 - 10 acres.

this area will not tolerate flooding or soil salinities greater than 10 ppt (Sapp, D.C., M.L. Cameron, and J.P. Stout. 1976. Alabama coastal marsh inventory. Alabama Geological Survey, Unique Report No. ALA-ADO-X996-CZM-11).

A more accurate description of the Tenneco site would be as follows: The flat eastern portion of the site is dominated by marsh elder and sea myrtle midstory with an understory of goldenrod. The higher western portion is dominated by wax myrtle and sea myrtle with stands of Cogongrass, locally known as 'Jap Grass' (Imperata cylindrica) and torpedo grass (Panicum repens). The lower southeastern-most portion traps rainwater after heavy rains and contains saltmarsh bulrush, smartweed, and saltgrass. This description has been added to paragraphs 4.2.1 and 5.1 of the FEIS.

14. See response to comment 13 above.
15. We fail to see a relationship between past dredging activities within the Pascagoula area and the direction of effluent coming from the disposal site.

The lack of discussion in the DEIS of the return flow from the upland sites was an oversight which has been corrected in the appropriate paragraphs of the FEIS.

16. As discussed in response to comment 13 above, saltmarsh bulrush (Scirpus robustus) and saltgrass (Distichlis spicata) occur in the site in scattered patches, but represent only a small percentage of the vegetation covering the site. Although black needlerush (Juncus roemerianus) was not sampled during the August survey, it would not be surprising to find it in scattered patches within the southeast portion of the site. Neither of these species however, would be considered a dominant member of the plant community of the Tenneco site.
17. Due to the highly motile nature of adult fish, the impacts of dredging and disposal are indirect and are traced primarily through impacts to their food sources such as benthos or plankton. These impacts were adequately addressed in the DEIS. Impacts to non-adult stages are more direct and were not adequately discussed in the DEIS. A discussion has been added to paragraph 5.2 of the FEIS to address these impacts.

As outlined in ER 200-2-2 dated 2 March 1981 entitled "Environmental Quality, Policy and Procedures for Implementing NEPA, Appendix A Feasibility Studies: Organization and Content of EIS's and Scoping", Section 5.0 of the EIS entitled "Environmental Effects" should briefly describe the effects of each detailed plan on the significant resources described in Section 4.0. The discussion of mitigation applicable to the recommended plan is contained in Section 6.0 entitled "Summary of Mitigation Measures".

1984, that the Environmental Protection Agency indicated that they believed the site to be a "water of the United States". Since this time further coordination with the Tennessee Gas Transmission Company indicates that the site will not be available for use as a disposal site at the projected construction date, therefore no controversy exists.

Section 6 paragraphs 6.1 - 6.6 of the DEIS presented a summary of the mitigation developed by the Corps during the planning for the navigation improvements at Pascagoula, Mississippi.

11. As discussed in response to comment 10, the Corps was unaware of the level of unresolved issues at the time of reproduction of the DEIS. Since the Tenneco site is unavailable for use, there are no unresolved issues at this time.
12. DEIS Table-1 was prepared to indicate the relationship of each of the alternative plans considered in detail to the environmental statutes. Plan E is in compliance with Executive Order 11990 which supports and complements the Clean Water Act. The 257 acre Tenneco site is not defined as a wetland within the framework of E.O. 11990 or the Clean Water Act, including Section 404(b)(1) of the Act.
13. Paragraph 3.2.5 of the FEIS has been changed to indicate that the Tenneco site is a scrub/shrub wetland rather than scrub/shrub habitat. Vegetative sampling of the eastern portion of the site (copy of the report is included in Appendix D to the Main Report) conducted in August 1984 indicated that ground cover species cover approximately 51% of that part of the disposal area. Included in these species are goldenrod (Solidago stricta, S. tenuifolia) 25% coverage; spiked sedge (Fimbristylis sp.) 9%; saltgrass, 6%; saltmarsh bulrush, 5%; saltwort (Salsola kali), 3%; smartweed (Polygonum sp.), 2%; and narrow leaved cattail (Typha angustifolia), sea myrtle, and smooth cordgrass less than 1% each. Woody plants greater than 3 feet in height included marsh elder, sea myrtle and wax myrtle. Estimates of 1,673 plants per acre of which 64% was marsh elder and 35% sea myrtle were made. The western portion of the site which is higher in elevation was not sampled due to inability to traverse the heavy woody midstory vegetation dominated by wax myrtle and sea myrtle. The southeastern most portion of the site traps rainwater and is characterized by saltmarsh bulrush, smartweed, saltgrass, and marsh elder.

The species of the southeastern portion are indicative of a number of different habitats thereby showing the highly variable nature of this portion of the site. Saltmarsh bulrush is typically found in areas above mean high water; smartweed is a freshwater marsh species; saltgrass characteristically occurs in meadows of the high marsh above normal tidal activity but may be found in higher salinity standing water; and marsh elder is found in higher elevations of the marsh. Spiked sedge which is the dominant ground cover species to the west of

use of the site as a disposal area is not compatible with their proposed plans for development of the site. For this reason, Plan E is considered to be non-implementable. Modified Plan A therefore has been designated the NED plan.

6. Comment noted. Due to the change in the recommended plan, no response to this comment is necessary.
7. The diked and previously filled disposal site, known as the Tenneco site, has been determined by the Corps not to be a "water of the United States" as defined by 33 CFR 323.2 specifically 323.2(a)(7). Therefore, the deposition of dredged or fill material in the diked portion of the site does not need to be specified according to the 404(b) Guidelines. Likewise, since the site is not a wetland per this definition, Executive Order 11990 does not apply.

Throughout the planning for the proposed improvements every means was taken to minimize or avoid impacts to the environment. A number of disposal site alternatives were rejected due to impacts which would result from their use. In addition, several elements of each of the plans have significant positive impacts on the area. These include the nourishment of Horn Island and the containment of the more polluted inner harbor sediments in upland sites. For these reasons, we disagree that the project was not planned within the full spirit and intent of the National Environmental Policy Act.

8. Comment is noted. As stated in paragraph 3.1.3a of the DEIS these sites were determined to be unsuitable for use as disposal sites due to a number of reasons including: current land use, adjacent land use, habitat, size, or distance from the dredging site. As discussed in the Main Report and DEIS, a telephone cable and three hydrocarbon transmission lines which underlie the channel alignment would be relocated.
9. In paragraph 3.2.5 of the DEIS, the Tenneco site was described as a scrub/shrub wetland. In undisturbed marshes these distinct communities usually occur on scattered topographic rises within the marsh or as a narrow transition zone between the marsh or forest habitats (Stout, J.P. and M.G. LeLong. 1981. Wetland habitats of the Alabama coastal zone. Alabama Coastal Area Board, Mobile, AL. Technical Publication CAB81-01, MESC Contribution No. 040.). The Tenneco site was grouped with the other proposed upland disposal sites due to their similar history and diked nature. We are in agreement that vegetative species common to wetlands do occur within the site; however, we do not believe that the interaction with the Mississippi Sound estuarine system is significant due to the height of the existing dike and elevations within the site.
10. At the time of reproduction of the DEIS, the Corps was unaware of the controversy over the jurisdictional nature of the site. The Corps's determination was made in April 1984 and it was not until July 19,

be +0.78 feet NGVD, therefore it would take an extremely high water level or high winds from the south/southeast to push Mississippi Sound waters into this site.

3. As discussed in the response to comment 2 above, the Tenneco site provides wildlife habitat. We do not agree that the site provides fishery benefits, nor with the degree of value assigned to the site by the FWS. A detailed response concerning these issues is presented in response to comment 2 above and in response to comment 21 below.

Assuming that detrital export may occur, it would occur only during times of extremely high rainfall or storm conditions. During these times, the export of detritus from adjacent areas is at its highest and it is debatable whether the detritus from the Tenneco site would be a significant addition to the estuarine system. In addition, data is not available on primary production rates or caloric value of detritus from scrub/shrub species such as those characteristic of the site therefore no estimate of the quality of the detritus can be made.

4. The draft Fish and Wildlife Coordination Act Report (FWCAR), dated June 20, 1984, evaluated five alternative plans. Of these, however, only Plans A and B were the same as those being evaluated by the Corps of Engineers (Corps). Plans C and D had been substantially changed and Plan E had been added in late April. Although the Fish and Wildlife Service (FWS) was aware of these changes they did not make the revisions in their draft report. In this report the FWS also developed a plan which they denoted as Plan E. On July 16, 1984, the FWS submitted a supplement to the FWCAR which evaluated the Corps alternative Plans C, D, and E. This supplement was received after the DEIS had been reproduced. Both FWS documents were included as Appendix D of the Feasibility Report and paragraph 6.7 of the DEIS stated: "The Final EIS for the Pascagoula Harbor Navigation Improvements will discuss their (FWS) evaluations and recommendations for any mitigative actions."
5. We do not agree with the FWS contention that the Tenneco site is providing valuable fish and wildlife benefits. The basis for this disagreement is discussed in response to comments 2 and 3 above and in more detail below at comment 21.

The Water Resources Council's ECONOMIC AND ENVIRONMENTAL PRINCIPLES AND GUIDELINES FOR WATER AND RELATED LAND RESOURCES IMPLEMENTATION STUDIES (P&G) has been adopted in its entirety by the Corps of Engineers as a part of its planning regulations. Corps of Engineers regulation ER 1105-2-30, GENERAL PLANNING PRINCIPLES, contains P&G Section 1.10.2, entitled "Selection", paragraph (a) of which states, in pertinent part, "The alternative plan with the greatest net economic benefit consistent with protecting the Nation's environment (the NED plan) is to be selected unless ... there is some overriding reason ...". Plan E therefore was selected as the recommended plan in the draft report. Further coordination with the Tennessee Gas Transmission Company indicates that

Response to U.S. Department of Interior, Regional Environmental Officer

- i. Comment noted. Further coordination with the Tennessee Gas Transmission Company indicated that use of the Tenneco site as a dredged material disposal site as proposed in the DEIS would not be compatible with their proposed schedule for development of the site. Although Plan E has the highest benefit/cost (B/C) ratio it is not implementable, therefore Modified Plan A becomes the recommended plan.
2. Comment Noted. On page Sec 4.2.1 of the FEIS, the description of the Tenneco site has been changed to indicate that it is a scrub/shrub wetland.

Wetlands have been described in the literature and in 33 CFR 320.4(b) to perform a number of functions important to the public interest including: feeding and nursery habitat for fish and shellfish; detrital export; waste assimilation; shoreline protection through reduction of wave energy; and wildlife habitat. Of these mentioned, the Tenneco site functions as wildlife habitat and maybe on rare occasions as an area of detrital export. Since the most valuable functions of feeding and nursery area, detrital export, waste assimilation and shoreline protection cannot be ascribed to this area due to its physical configuration, we do not agree that this site is a functional wetland.

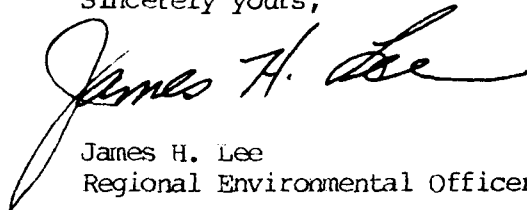
The site is dominated by marsh elder (Iva frutescens), sea myrtle (Baccharis halimifolia), and wax myrtle (Myrica cerifera) with an understory of goldenrod (Solidago sp.) and torpedo grass (Panicum repens). The lower southeastern portion traps rainwater after heavy rains and contains saltmarsh bulrush (Scirpus robustus), saltgrass (Distichlis spicata), and smart weed (Polygonum sp.). Saltmarsh hay (Spartina patens) and black needlerush (Juncus roemerianus) are not dominant species on the site. The manmade intertidal wetland south of the proposed site is characterized by saltgrass (37% coverage) and smooth cordgrass (Spartina alterniflora) (31%). An unaltered emergent wetland area adjacent to the proposed site to the east is characterized by saltgrass (40%), smooth cordgrass (17%), and black needlerush (10 %). A more detailed description of the site may be found in response to your comment 13 below.

The area was surveyed in March 1978 and at this time the southern dike was intact and averaged 7 feet above mean low water (MLW). Inspection of the dike in August 1984 indicated that the dike was still intact. In the southeastern-most portion of the dike there is a notch in the dike wall where the return flow weir structure was located. Inspection of this area in August 1984 indicated that the floor of the weir box was in place. The elevation of this area is approximately 3 feet above MLW. The return water outlet ditch bisects the wetlands to the south and extends underneath the floor of the weir box and into the site for a distance of approximately 50 feet. The width of the ditch is 12 feet and bottom elevation in the ditch where it enters the site is 1 foot above MLW. Mean high water level for this area has been determined to



23 | referral is likely and the only means of resolving this issue. We  
| may, therefore, refer this project to the CEQ under Section 1504 of  
| the Council's Regulations for Implementing the Procedural Provisions  
| of the National Environmental Policy Act. The FWS, however, will  
| continue to coordinate this matter with the Corps and other agencies  
| in an attempt to resolve these issues and avoid the referral process.

Sincerely yours,

A handwritten signature in cursive script, reading "James H. Lee". The signature is written in dark ink and is positioned above the typed name and title.

James H. Lee  
Regional Environmental Officer

16 Page 34, Paragraph 5.1 - The 257 acre Tenneco tract also contains species such as Juncus roemerianus, Scirpus robustus, and Distichilis spicata.

17 Page 34, Paragraph 5.2 - Adverse impacts to fishery resources would occur with each plan as described in the Draft Fish and Wildlife Coordination Act Report. These impacts and mitigation should be specifically addressed in this section for each alternative.

18 The time of year that the dredging is conducted could also have an impact on fishery resources and should be addressed in this section.

19 Page 36, Paragraph 5.3 - Wildlife impacts would occur with each of the alternatives as described in the Fish and Wildlife Coordination Act Report. These impacts and mitigation should be specifically described in this section.

20 Page 44, Paragraph 6.5 - The statement that Alternative D would have a significant positive impact on the coastal environment of Mississippi and Alabama is debatable. While it does show an improvement for some species, it also could result in losses of others. This is primarily due to the enormous amounts of fill (approximately 810 acres) that would occur. This 810 acres would be in shallow productive waters within Point Aux Chene Bay. This amount of open water loss cannot be ignored and the filling of this area would result in negative impacts for many aquatic organisms. The FWS has recommended that this amount of fill be significantly reduced to about 80 acres.

21 Page 44, Paragraph 6.6 - The FWS believes that the selected plan (E) does not avoid wetland impacts associated with dredged material disposal within the Tenneco area.

#### Summary

22 We believe that the DEIS is inadequate because it does not accurately address the impacts and mitigation of the alternatives and specifically the Tenneco site filling of Plans C and E. The fish and wildlife resources, impacts to the resources, and mitigation necessary for the Corps NED plan (E) are described in the Draft Fish and Wildlife Coordination Act Report dated June 1984. The severity of these impacts is such that the FWS cannot support such a plan. We still maintain that Plan B is feasible and should be selected.

23 Negotiations between FWS and the Corps to date have not resulted in any resolution relative to the filling of the 257 acres wetland at the Tenneco site. It appears that this situation may persist. In view of this, the FWS believes that a Council on Environmental Quality (CEQ)

Response to U.S. Department of Commerce, National Oceanic and Atmospheric Administration

1. Comment noted. A discussion of the Section 7 Consultation has been added to the FEIS. The appropriate letters have been added to Appendix D of the Technical Appendices.
2. Comment noted. We do not agree, however, that the rationale used to choose the selected plan was flawed.
3. Comment noted. For a detailed discussion concerning these issues, please refer to responses to the comments numbered 1, 2, 3, 5, 6, 13, and 21 in the U.S. Department of Interior letter dated 6 September 1984.



STATE OF MISSISSIPPI  
OFFICE OF THE GOVERNOR

Beverly W. Hogan  
Executive Director  
Federal-State Programs

Sandra B. Irby  
Director  
Department of Planning and Policy

MEMORANDUM

TO: Department of the Army  
Mobile District, Corps of Engineers  
P. O. Box 2288  
Mobile, Alabama 36628-0001

DATE: 8-20-84

FROM: STATE CLEARINGHOUSE FOR FEDERAL PROGRAMS

SUBJECT: REVIEW COMMENTS

Activity: Draft Feasibility Report & Draft Environmental Impact Statement for the tentatively selected plan for navigation improvements within Pascagoula Harbor, MS.

State Application Identifier Number: MS840723-005

Location: Jackson Co./Southern

Contact: Willis E. Ruland

The State Clearinghouse, in cooperation with state agencies interested or possibly affected, has completed the review process for the activity described above.

INTERGOVERNMENTAL REVIEW PROCESS COMPLIANCE:

- ( ) We are enclosing the comments received from the state agencies for your consideration and appropriate action. The remaining agencies involved in the review did not have comments or recommendations to offer at this time. A copy of this letter is to be attached to the application as evidence of compliance with Executive Order 12372 review requirements.
- (x) None of the state agencies involved in the review had comments or recommendations to offer at this time. This concludes the State Clearinghouse review, and we encourage appropriate action as soon as possible. A copy of this letter is to be attached to the application as evidence of compliance with Executive Order 12372 review requirements.
- ( ) The review of this activity is being extended for a period not to exceed 60 days from the receipt of notification to allow adequate time for review.

COASTAL PROGRAM COMPLIANCE (Coastal area activities only):

- ( ) The activity has been reviewed and complies with the Mississippi Coastal Program. A consistency certification is to be issued by the Bureau of Marine Resources in accordance with the Coastal Zone Management Act.
- ( ) The activity has been reviewed and does not comply with the Mississippi Coastal Program.
- ( ) Not Applicable

EIS-65

cc: Funding Agency (As requested by agency)

Response to State of Mississippi, State Clearinghouse for Federal Programs

Comment noted. No response necessary.

September 10, 1984



WILLIAM A. ALLAIN  
Governor

**MISSISSIPPI  
DEPARTMENT  
OF WILDLIFE  
CONSERVATION**

**Bureau of  
Marine Resources**

P. O. Drawer 959  
Long Beach, MS 39560  
(601) 864-4602  
Enforcement  
Division - 374-3205

**Commissioners:**

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Oxford, MS

Jim Hunter McCaleb  
Cleveland, MS

Lonnie Tadlock  
Morton, MS

A. G. Williams  
Osyka, MS

Joseph W. Gex  
Bay St. Louis, MS

Lon Strong  
Executive Director

Richard L. Leard  
Bureau Director

Dr. Susan Ivester Rees  
Environmental Studies and  
Assessment Branch  
U.S. Army Corps of Engineers  
P. O. Box 2288  
Mobile, AL 36628

Dear Dr. Rees:

The Bureau of Marine Resources has reviewed a copy of the Draft Feasibility Report for Pascagoula Harbor, Mississippi. After careful review of the alternative plans outlined in the report and our assessment of the impacts associated with the alternatives, we offer the following comments.

1 The Corps of Engineers should be complemented on their efforts to develop a plan which avoids significant environmental impacts. We were particularly pleased to see that the Corps' selected plan included disposal options for deep gulf disposal. The Bureau of Marine Resources has expressed concern over the years about open water disposal in Mississippi Sound. We feel that deep gulf disposal is a viable disposal alternative and we continue to advocate the use of this disposal method for this and other projects.

2 Based on our review of the alternative plans outlined in the Draft Feasibility Report, the Bureau of Marine Resources feels that Plan B is the best option. The elements of this plan have more positive environmental features and less negative environmental features than any other plan developed by the Corps of Engineers and the Benefit/Cost Ratio is comparable to the selected plan.

The Bureau of Marine Resources has gone on record to support efforts by the Corps of Engineers to incorporate a project element for rebuilding Grande Batture Island using dredge material from the Bayou Casotte channel. This element was included in Plan D but eliminated from further consideration because of cost.

3 Because of the importance of the Pt. Aux Chenes Bay/Bangs Lake Area and because of the alarming rate at which wetlands are being eroded in this area the BMR feels that the rebuilding Grande Batture Island in some form should be included in the final plan.

We feel the island chain could be successfully rebuilt on a much smaller scale than proposed by the Corps thus reducing cost. This alternative was discussed by the U. S. Fish & Wildlife Service in their Draft Fish & Wildlife Coordination Act report for Pascagoula Harbor and we believe this renourishment feature should be incorporated into the Corps' final plan.

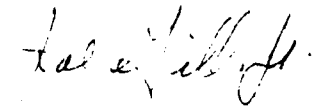
4 Giving full consideration to all the above, the Bureau of Marine Resources recommends that Plan B, with a small-scale renourishment

Dr. Susan Ivester Rees  
September 10, 1984  
Page two

4 feature for the Grande Batture Island chain, be adopted as the selected plan for channel improvements at Pascagoula Harbor. Because of the high benefit/cost ratio associated with the Pascagoula Harbor project we feel that this small-scale rebuilding feature can be incorporated into the plan without adversely affecting the b/c ratio of the project.

We look forward to working with the Corps of Engineers and other regulatory and resource agencies to develop a disposal plan which will provide the maximum benefits to the public and to public resources.

Sincerely,

  
(FOR) Richard L. Leard, Ph.D.  
Bureau Director

RLL:PLL:bh

cc: U.S. Fish & Wildlife Service

Response to Mississippi Department of Wildlife Conservation, Bureau of Marine Resources

1. Comment noted. No response necessary.
2. Comment noted. For a detailed discussion concerning this issue, please refer to response to comment numbered 5 in the U.S. Department of Interior letter dated 6 September 1984.
3. We concur with the Bureau of Marine Resources concerning the value of the Point aux Chenes marsh and the value to be gained in reconstructing the Grande Batture Islands. The original plan was designed to mimic the original shoreline with the fill occurring within the 3-foot contour. In addition, this area would have contained all of the new work materials from the Bayou Casotte improvements. Other iterations on this design are possible and the Corps of Engineers will work with the Bureau and other interested parties to attempt to produce a plan which would be both functional and acceptable.
4. One objective of the NED plan is to maximize net benefits. A rudimentary breakwater is considered an absolute necessity for Plan D to prevent the future erosion of the restored island(s). The cost of such a breakwater is estimated to be about \$8 million. The interest and amortization of that cost, at 8-1/8 percent interest for 50 years, would amount to \$666,000 annually. The U.S. Fish and Wildlife Service estimated the benefits from protecting the marshes in that area at \$66,683 annually (Fish and Wildlife Coordination Act Report, Appendix D). Since the costs of rebuilding Grande Batture are high and the benefits are low, it cannot be recommended as a feature of the proposed plan. There is ample provision, however, in both law and policy for a local or State Government to pay the difference in the increased cost of dredging or material disposal if a use for the material other than the least-cost disposal is desired. This is a matter that could be worked out during the Continuing Planning and Engineering phase of the project.





MISSISSIPPI DEPARTMENT OF NATURAL RESOURCES  
Bureau of Pollution Control  
P. O. Box 10385  
Jackson, Mississippi 39209  
(601) 961-5171



September 11, 1984

Willis E. Ruland, Chief  
Environment and Resource Branch  
Mobile District, Corps of Engineers  
P. O. Box 2288  
Mobile, Alabama 36628

Dear Mr. Ruland:

This responds to your letter of July 18, 1984, regarding the Draft Feasibility Report and Draft Environmental Impact Statement (DEIS) for the tentatively selected plan for navigation improvements within Pascagoula Harbor, Jackson County, Mississippi.

1 The Draft Feasibility Report specifies Plan E as the COE's selected plan for the navigation channel improvements of Pascagoula Harbor. Plan E combines the plan elements for Gulf disposal for material from the main channel and deposition on the Tenneco property for material from new work on the Bayou Casotte Channel, retaining the inner harbor and entrance channel elements which are common to all plans. Inner harbor spoil from the Pascagoula River and Bayou Casotte is to be placed in contained, upland disposal areas (Greenwood Island, Singing River Island, Double-Barrel Site). Entrance channel spoil will go to "Area D", an existing disposal area offshore of Horn Island.

2 The report describes the Tenneco site as property that has previously been used for spoil disposal, with much of the site still surrounded by the original dike system. However, because of breaks in the old dike system allowing tidal influence, portions of the site apparently contain functional wetlands and it is now our understanding that EPA is considering asserting federal jurisdiction over these wetlands. Should EPA determine that the Tenneco site contains jurisdictional wetlands, the justification for Plan E is not valid since a major portion of the justification is that it avoids impacts inherent in wetland disposal.

3 If EPA does assert federal jurisdiction, the Bureau recommends Plan B, with mitigation, be substituted for Plan E. Plan B retains the inner harbor and entrance channel elements and requires all new work and maintenance material be taken to deep Gulf sites. We believe this to be a reasonable alternative both from an economic and environmental standpoint. Also, to reduce ongoing erosion, we recommend nourishment and rip-rap armoring of the Grande Batture Island Chain on a scale that has been proposed by the U.S. Fish and Wildlife Service.

Mr. Willie E. Rutland, Chief  
September 11, 1984  
Page -2-

Thank you for the opportunity to comment on this project.

Very truly yours,

A handwritten signature in cursive script, appearing to read "Charles H. Chisolm".

Charles H. Chisolm  
Bureau Director

CHC:JMM:cdc

cc: Larry Goldman, Fish & Wildlife, Daphne, Alabama

esponse to Mississippi Department of Natural Resources, Bureau of Pollution  
ontrol

- . Comment noted. No response necessary.
- . Comment noted. For a detailed discussion of this issue, please refer to responses to comments numbered 2, 3, 13, and 21 in the U.S. Department of Interior letter dated 6 September 1984.
- . Comment noted. In response to your recommendation concerning nourishment of Grande Batture, please refer to response to comment numbered 4 concerning economic restraints in the Mississippi Department of Wildlife Conservation, Bureau of Marine Resources letter dated 10 September 1984.

GULF COAST RESEARCH LABORATORY

EAST BEACH

OCEAN SPRINGS, MISSISSIPPI 39564

THE DIRECTOR'S ROOM

September 10, 1984

Mr. Willis E. Ruland, Chief  
Environment and Resources Branch  
Dept. of the Army  
Mobile District Corps of Engineers  
P. O. Box 2288  
Mobile, AL 36628-0001

ATTN: SAMPD-N

RE: Pascagoula Harbor, Mississippi  
Draft Feasibility Report and Environmental Impact Statement

Dear Mr. Ruland:

We have reviewed the above report and wish to formally submit the following comments for the public record:

1 We are vitally concerned with the possible filling of 257 acres of wetlands in the Tenneco site (Re: Plan E, page EIS-13-14). If the wetlands in that spoil disposal site are declared "Section 404" wetlands by the Environmental Protection Agency, their loss would have to be mitigated by the Grande Batture Island project and other mitigative projects such as the nourishment of Round Island. In our earlier correspondence on this project (Re: Appendix E-8, Volume II) we supported island nourishment as a means of stabilizing Mississippi's barrier islands. We now reiterate that concept as mitigation for the proposed loss of wetlands involved with this project.

2 The Gulf Coast Research Laboratory supports in principal the deepening of the Pascagoula Harbor and connecting channels including turning basins. We are opposed, however, to those aspects of the project that will result in the loss of wetlands without proper mitigation. The Laboratory recommends a modification of Plan E (Volume I, of subject report, page EIS 12-13) as outlined below:

3 1. The creation of 810 acres of wetlands on the Grande Batture Islands and the protective influence of the 18,000-foot rock jetty will have a long-term, positive effect on the pristine wetlands north and west of those islands in the Ft. aux Chenes Bay area. The creation of those wetlands and the prevention of wetland loss in that area will adequately mitigate the loss of the approximate 165 acres involved in the actual dredging and filling required by this project. While we are aware that funding may be a matter of vital concern for this plan, we believe the additional funds can be correctly justified in terms of protecting our valuable wetlands and insuring continued seafood productivity in that area of Mississippi Sound.

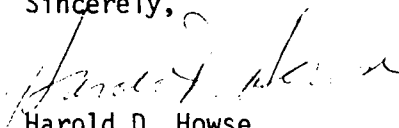
Mr. Willis E. Ruland  
September 10, 1984  
Page 2

2. After careful study and consultations with marine geologists and marine botanists, we believe that the proposed location of the Horn Island Disposal Area "D" is inappropriate if it is the Corps' intent to add new sand (spoil) to the "sand budget" of that island. We recommend, therefore, that Area "D" be relocated immediately east of Horn Island thus permitting sand to move onto and along both sides of the island. The east end of the island is eroding very rapidly and the submerged grassflats along the north side will be lost as the island "migrates" westward unless new sand is added to the system. Our marine botanist believes that the movement of sand from a disposal site immediately east of Horn Island would be slow enough to permit continued upward growth of submerged vegetation and thereby prevent the suffocation (burial) of the grassflats under normal circumstances. We respectfully request, therefore, that you restudy the location of Horn Island Disposal Site "D."

3. Round Island is in need of additional substrate to prevent its eventual destruction via erosion. Consequently, we recommend that the Mobile District conduct an indepth study of the island, its geological status, its private/public ownership, its protected status as a unit of the 1982 Coastal Barrier Resources Act (CBRA), and the feasibility of disposing materials from the Upper Pascagoula Channel onto the east side of that island. While we are aware that the CBRA prevents the expenditure of public funds for the development of Round Island, we believe that the protection of that island for future public use as a park can be accomplished by nourishment with proper spoil materials provided there is coordination and approval with the U.S. Department of the Interior. The utilization of a Round Island disposal site would minimize the loss of benthic fauna, reduce navigation hazards, and minimize the interference with the east-west circulation within the Sound, now caused by the disposal areas situated west of the Main Pascagoula Channel. The historic nature of the old Round Island Lighthouse necessitates its protection with, if appropriate, spoil additions to the south side of the island. We believe that the use of one or more in-line, booster pumps will permit the movement of spoils from the Main Pascagoula Channel to Round Island.

Thank you for the opportunity to submit these comments and suggestions.

Sincerely,

  
Harold D. Howse  
Director

mIf

cc: Dr. Susan Ivester Rees

Response to Gulf Coast Research Laboratory

1. Further coordination with the Tennessee Gas Transmission Company indicated that the use of the Tenneco site as a disposal area conflicted with the proposed schedule for their development of the Tenneco site. Since this site is no longer available for use, Plan E as described in the DEIS is not implementable. Based on this information Modified Plan A is the recommended plan and the issue of the Tenneco site is not relevant to the proposed action.
2. Comment noted. For a detailed discussion concerning this issue refer to response to comment numbered 21 in the U.S. Department of Interior letter dated 6 September 1984.
3. We agree as to the long-term positive effect the reconstruction of the Grande Batture Islands would have on the Point aux Chenes marsh. For a detailed discussion of economic responsibility please refer to the response to comment numbered 4 in the Mississippi Department of Wildlife Conservation, Bureau of Marine Resources letter dated 10 September 1984.
4. Studies performed during the Mobile District's Mississippi Sound and Adjacent Areas Study led to our conclusion that disposal east of the island could possibly have adverse impacts on the grassbeds of Mississippi Sound. However, with your information in hand, further studies will be coordinated with personnel of the laboratory on the siting of this disposal area during the Continuing Planning and Engineering (CP&E) phase of this study.
5. The Corps of Engineers is committed to the productive use of dredged materials and will investigate the feasibility of utilizing Round Island as a possible site for island nourishment during CP&E. We will coordinate these investigations closely with the Gulf Coast Research Laboratory staff.

# OBSTETRICS, GYNECOLOGY, INFERTILITY ASSOCIATES; P.A.

K C HOOVER MD FACOG  
MAS R SINGLEY MD FACOG

BRUNER B BOSIO MD FACOG  
OWEN P PHILLIPS MD

DOCTORS PLAZA SUITE 208 - TELEPHONE 769 1940  
PASCAGOULA, MISSISSIPPI 39567

8/23/84

Colonel Patrick J. Kelly, Dist. Engineer  
Group of Engineers, Mobile District  
P.O. Box 2288  
Mobile, Ala. 36628

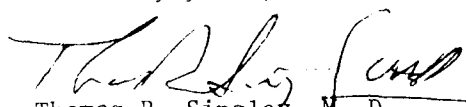
Dear Sir:

I am writing concerning the dredging permit application for  
opening the Pascagoula Channel. I concur the need for the  
additional depth. My concern is with the proposed spoils disposal  
plan.

I understand that the proposal recommended would include filling  
approximately 200 acres of marsh. The remaining marshland in our  
area must be protected from such destruction. Our continued seafood  
resource and healthy marine environment vitally depends on adequate  
marshlands.

From the news reports there is another proposal with almost the same  
cost-benefit ratio that would not require marsh filling. I urge your  
most consideration in deciding this issue to protect our marsh.

Sincerely yours,

  
Thomas R. Singley, M. D.

D

**D**



AD-A154 884

PASCAGOULA HARBOR MISSISSIPPI FEASIBILITY REPORT ON  
IMPROVEMENT OF THE FE. (U) CORPS OF ENGINEERS MOBILE AL  
MOBILE DISTRICT MAR 85 COE-SAM/PD-N-84/011

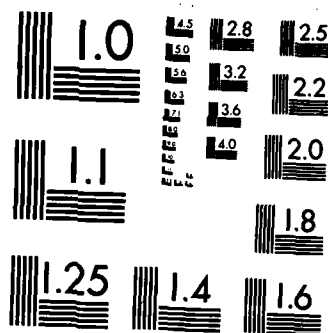
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9.0 Index, References and Appendices: Table EIS-5 provides an alphabetized subject index with references to the FEIS, Main Report, and report appendices.

TABLE EIS-5

INDEX, REFERENCES AND APPENDICES  
USED IN THE PREPARATION OF DEIS FOR PASCAGOULA HARBOR, MISSISSIPPI NAVIGATION IMPROVEMENTS

SUBJECTS	STUDY DOCUMENTATION		
	ENVIRONMENTAL IMPACT STATEMENT	MAIN REPORT (References Incorporated)	DRAFT REPORT APPENDICES (References Incorporated)
Abstract	EIS 1	None	N/A
Affected environment	EIS 17 - EIS 23 Sec. 4.0 para. 4.1 - 4.2.19	Pages 8-37; Pages 38-42	Appendix A Appendix C Appendix D
Alternatives	EIS 6 - EIS 17 Sec. 3.0 para. 3.1 - 3.2.8	Pages 57-70	Appendix B
Areas of controversy	EIS 3 para. 1.2	None	N/A
Environmental conditions	EIS 17 para. 4.1	Pages 8-37; Pages 38-42	Appendix A Appendix C
Environmental effects	EIS 23 - EIS 35 Sec. 5.0 para. 5.1 - 5.19	None	Appendix D
List of preparers	EIS 40 para. 7.0	None	N/A
Major conclusions and findings	EIS 3 para. 1.1	Pages 81-82	Appendix B
Mitigation measures	EIS 35 - EIS 40 Sec. 6.0	Page 72	Appendix D
Need for and objectives of action	EIS 3 Sec. 2.0 Sec. 2.0 para. 2.1 - 2.3	Pages 42-44	None

TABLE EIS-5 (cont.)

INDEX, REFERENCES AND APPENDICES  
USED IN THE PREPARATION OF DEIS FOR PASCAGOULA HARBOR, MISSISSIPPI NAVIGATION IMPROVEMENTS

STUDY DOCUMENTATION			
SUBJECTS	ENVIRONMENTAL IMPACT STATEMENT	MAIN REPORT (References Incorporated)	DRAFT REPORT APPENDICES (References Incorporated)
Planning Objectives	EIS 6 para. 2.3	Page 5	None
Plans considered in detail	EIS 8 - EIS 17 para. 3.2 - 3.2.8 Table EIS-2	Pages 61-68	Appendix B Appendix D
Plans eliminated from further study	EIS 6 - EIS 8 para. 3.1 - 3.1.3	Pages 57-60	None
Public concerns	EIS 6 para. 2.2	Pages 42-44	None
Public involvement	EIS 41 para. 8.0	Page 2	Appendix E
Public views and responses	EIS 43 para. 8.5	Pages 79-80	Appendix D
Public involvement program	EIS 41 para. 8.1	Page 2; Pages 79-80	Appendix E
References	EIS 78 Sec. 9.0	Pages 83-86	N/A
Relationship to environ- mental requirements	EIS 3 para. 1.4 Table EIS-1	None	N/A
Required coordination	EIS 41 para. 8.2	Pages 45-47	Appendix E

Table 5 (Con't)

INDEX, REFERENCES AND APPENDICES  
USED IN THE PREPARATION OF DEIS FOR PASCAGOULA HARBOR, MISSISSIPPI NAVIGATION IMPROVEMENTS

STUDY DOCUMENTATION			
SUBJECTS	ENVIRONMENTAL IMPACT STATEMENT	MAIN REPORT (References Incorporated)	DRAFT REPORT APPENDICES (References Incorporated)
Significant resources	EIS 17 - EIS 23 para. 4.2 - 4.2.19	Pages 79-80	Appendix D
Statement recipients	EIS 41 - EIS 42 para. 8.3	None	N/A
Study authority	EIS 3 para. 2.1	Pages 1-2	N/A
Summary	EIS 3 Sec. 1.0 para. 1.1 - 1.5	Pages ES-1 - ES-3	N/A
Table of contents	EIS i - EIS ii	Pages i - v	N/A
Unresolved issues	EIS 3 para. 1.3	None	N/A

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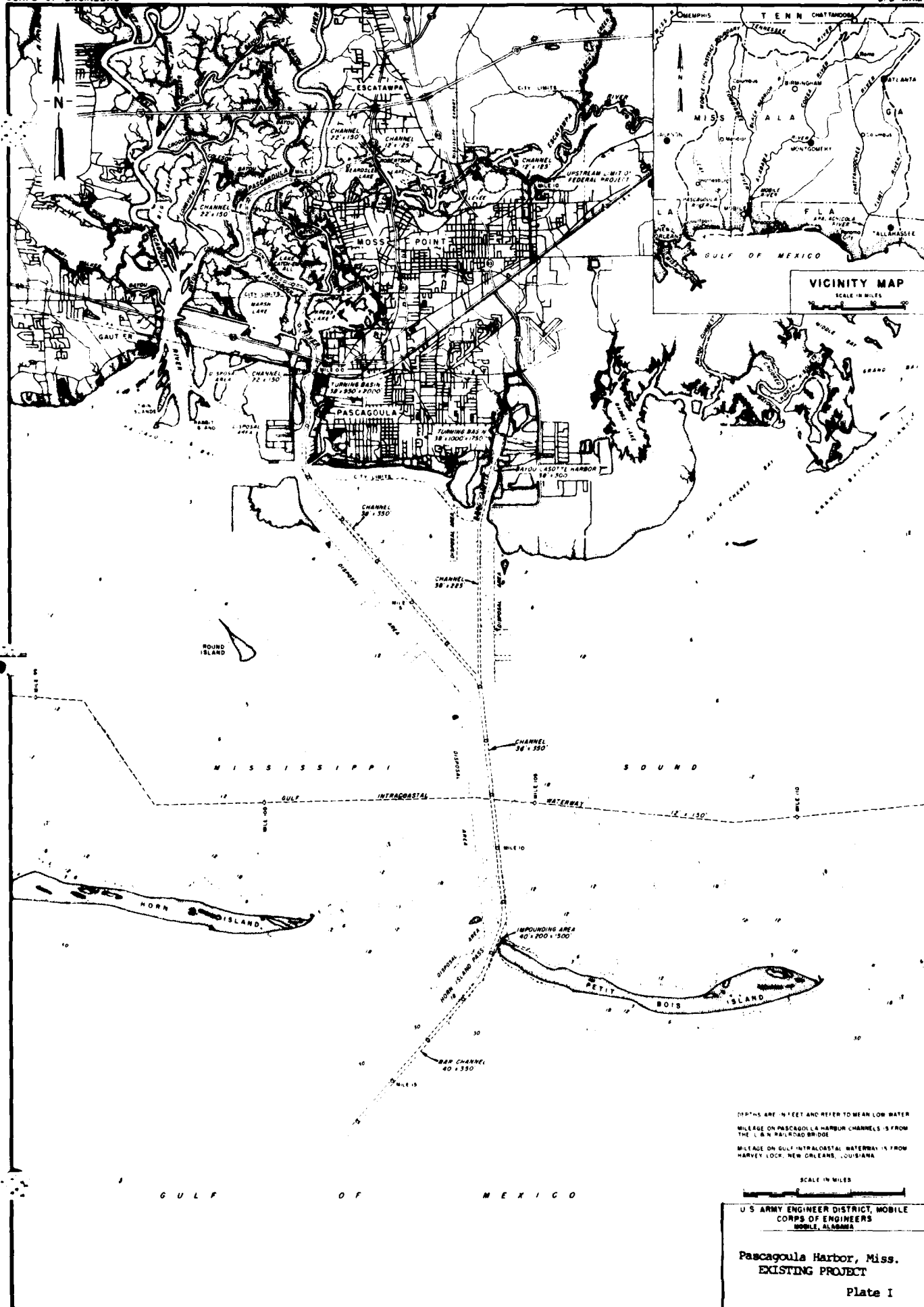
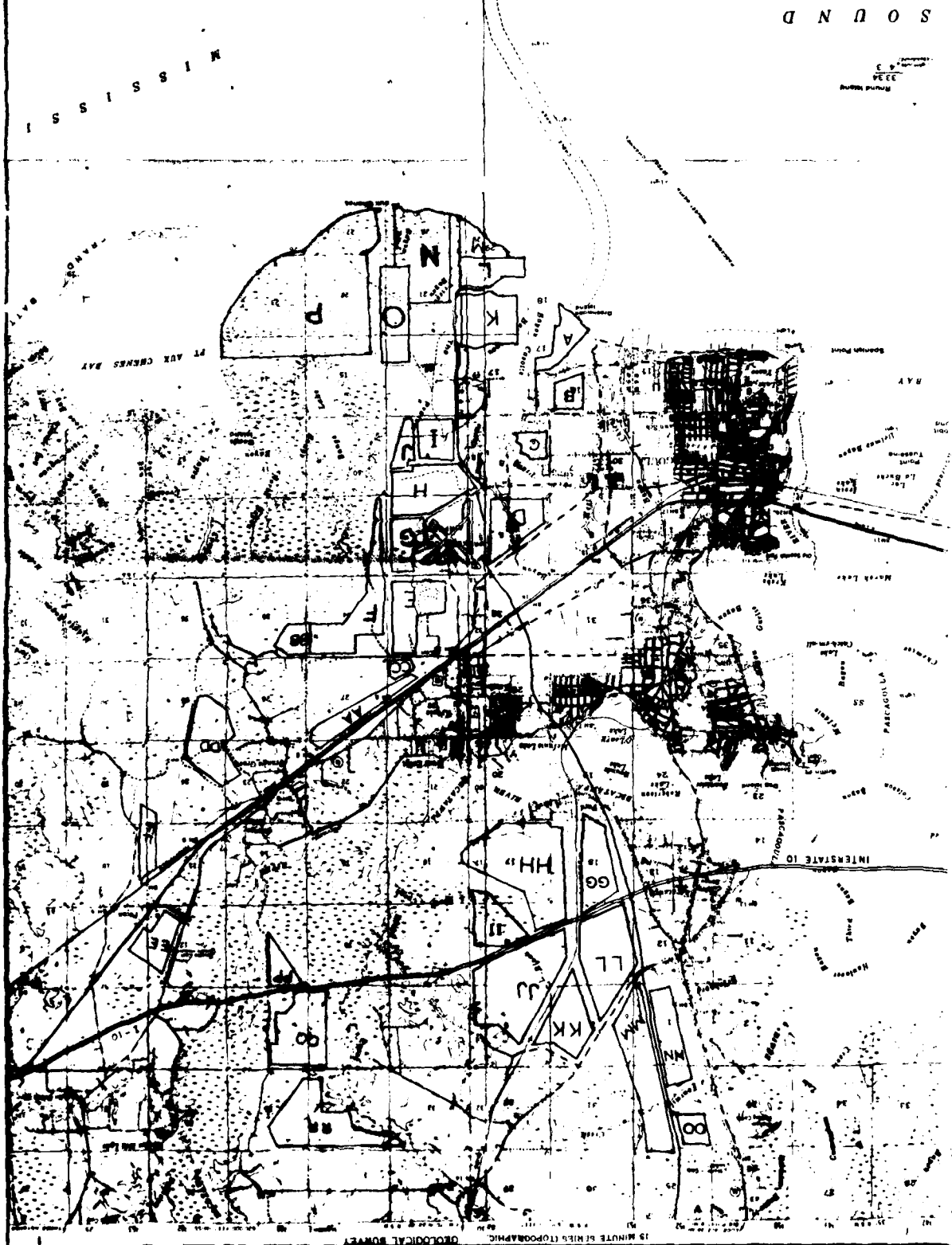
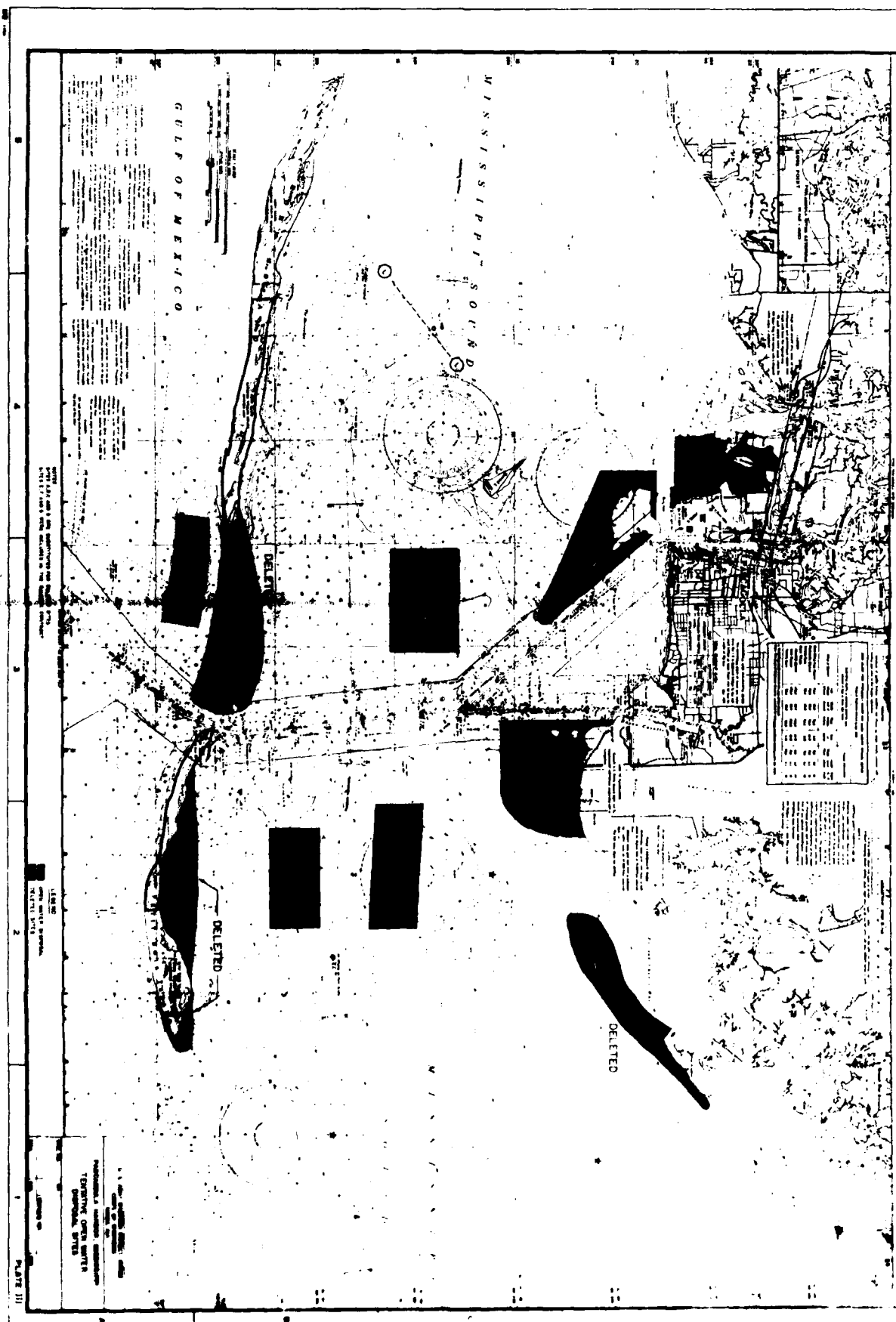
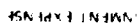


PLATE II  
TENTATIVE UPLAND DISPOSAL SITES  
PASCAGOULA HARBOR, MISS.  
SCALE 1:62,500





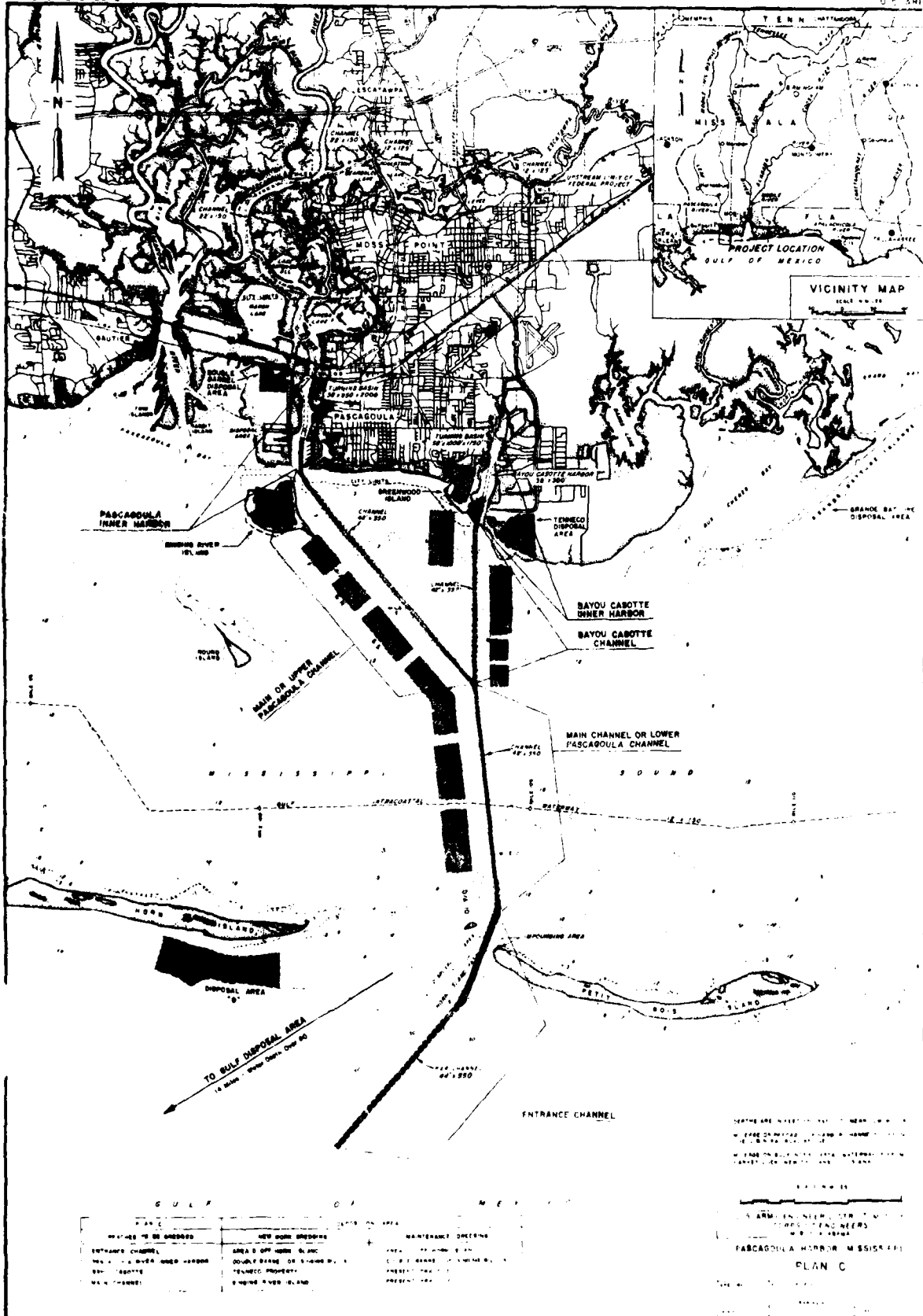
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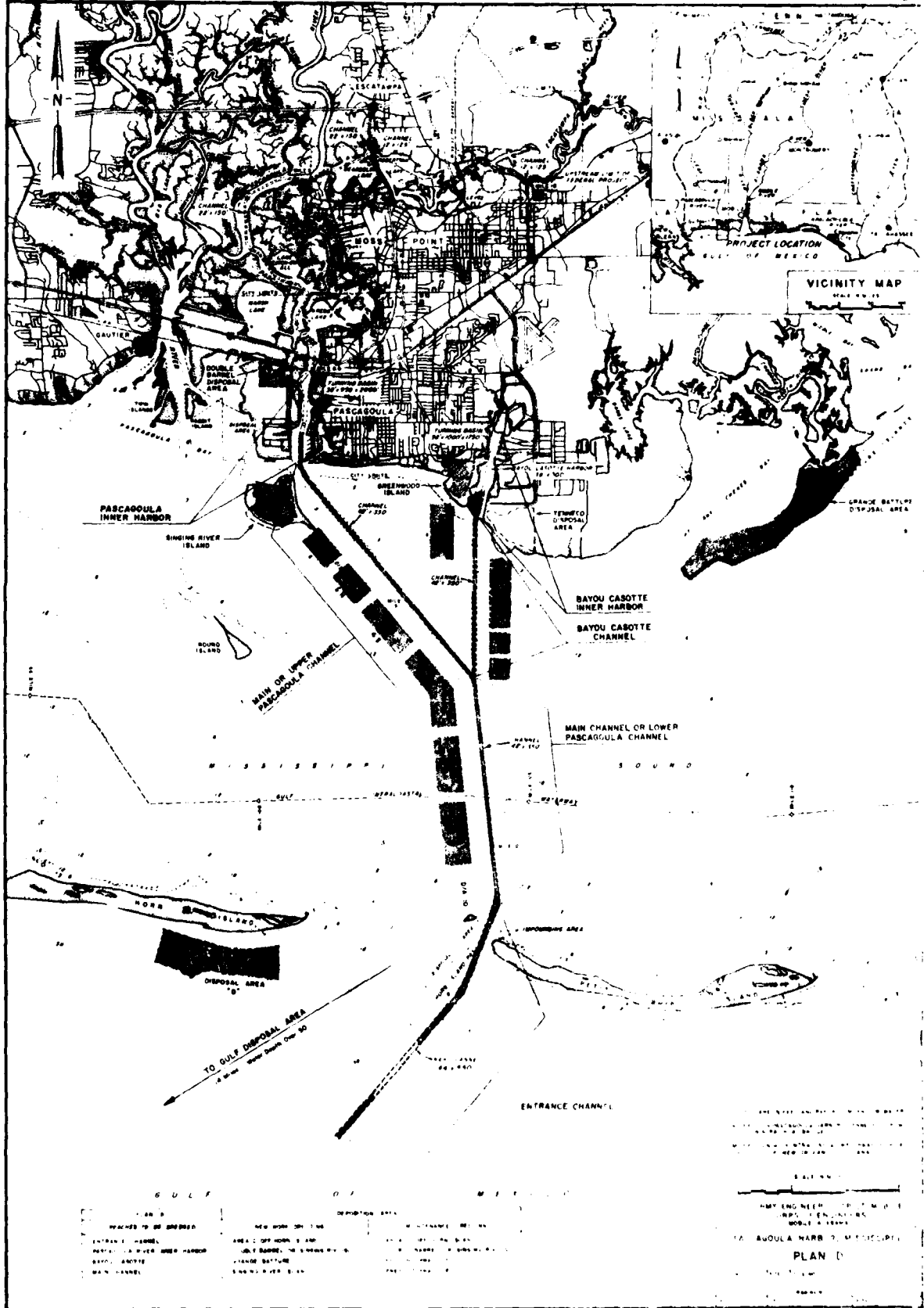


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